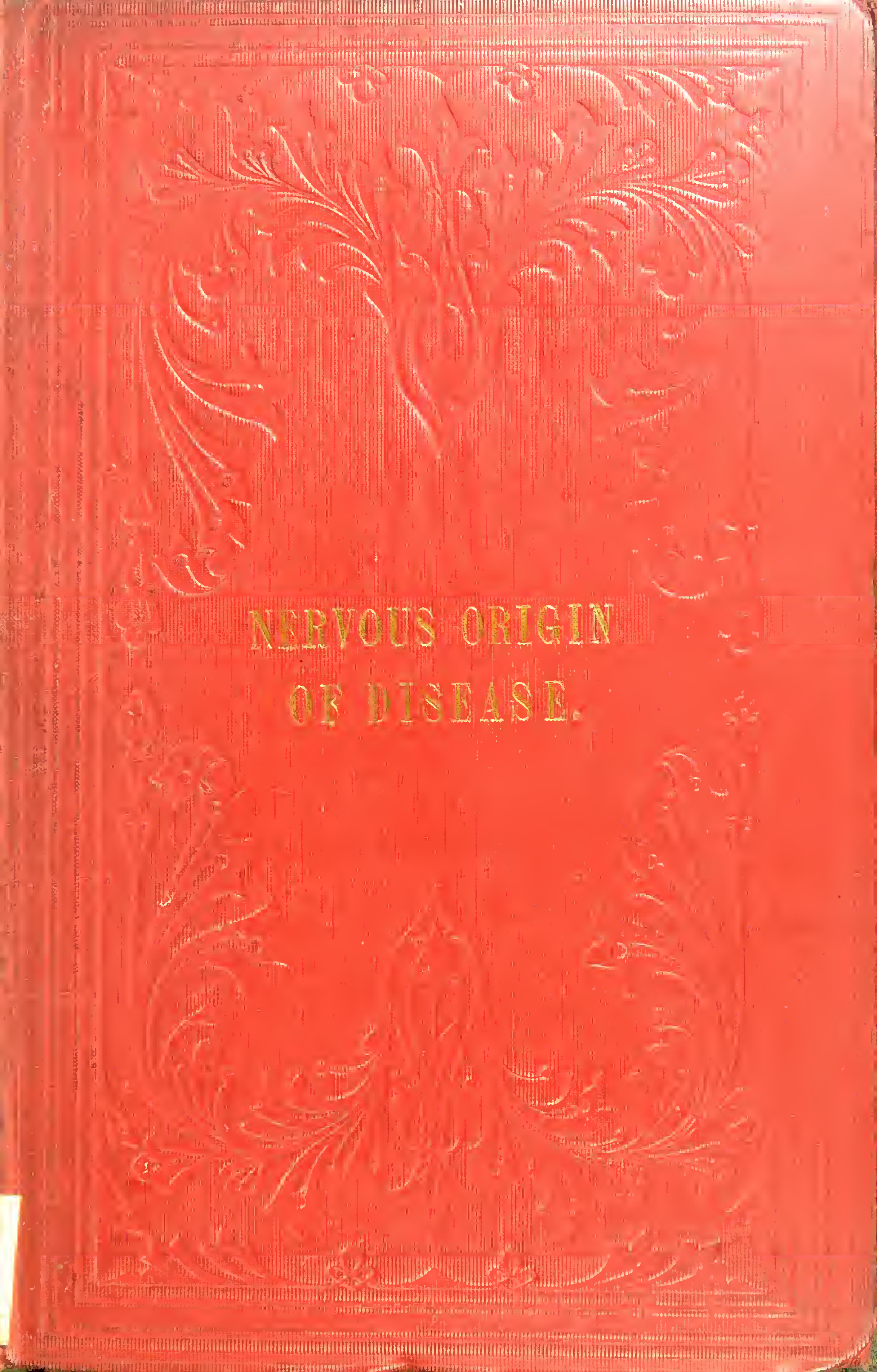

NERVOUS ORIGIN OF DISEASE.

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NEUROPATHOLOGY;

OR THE

NERVOUS ORIGIN OF DISEASE.

BY

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TO THE

MEDICAL PROFESSION,

THIS WORK,

ON THE

NERVOUS ORIGIN OF DISEASE,

IS RESPECTFULLY DEDICATED BY

THE AUTHOR.

ERRATA.

Page 26—“*naked*” read “*for naked*”
do.—“*as tight lacing*” read “*by tight lacing*”
46—for “*tropical*” read “*topical*”
48—for “*in inflammation*” read ,‘*inflammation*”
53—for “*hangs*” read “*hang*”
85—for “*Let be*” read “*Let me be*”
86—for “*whea*” read “*when*”
93—for “*sensiblity*” read “*sensibility*”
do.—for “*he*” read “*be*”
97—for “*they are*” read “*it is*”

PREFACE.

The following Essay has been undertaken with the intention of affording a more easy method, and encreased facilities, for the Diagnosis and Treatment of Disease. The undeviating results of experimental investigation in the fields of Nature, up to the present time, have been to remove the vail of mystery and complexity—which envelope her Laws and Phenomena—and present them to us in the beauteous garb of truthful simplicity. Truth, and simplicity have always thus been seen hand in hand, as twin sisters! Every advance also in the sphere of modern Medical investigation—has equally tended to simplify the Laws and Phenomena of Organic Life. Each step, therefore, that has been taken in these two Sciences—has thus rendered the resources and powers of Nature—more tractable and available for the succour, wants, and comforts of Man. The attempted simplification of the at present—Hydra-headed Monster—Disase—with its multiform phases, types, and orders—genera and species—into a few normal and essential conditions of the Nervous System—evidently and practically admitted in detail by the most eminent medical authorities, who have laboured in the various individual branches of the Healing Art—(of which, only a few specimens at hand have been adduced)—appears to the Author as a subject worthy the attention of those who seek Truth, and the general advancement of Science.

The inductive process necessary for the Diagnosis and Treatment of Disease—must be by this mode exceedingly facilitated and simplified. The mind has here only one main object to contemplate,—one system principally to investigate,—the operation of definite causes upon that one system,—and its secondary effects upon other organs, and functions. The treatment, too, must be vastly more efficient and certain in its results, when we ascertain with facility the origin and nature of the complaint—and the particular part or structure of the body, which is the primary and essential subject of the attack. At all events, the Author has himself adopted this mode of viewing and treating Disease, for a considerable period, and is candid to confess, that by looking solely to the *state of the Nerves*, as the origin of the malady under Treatment, and adopting his remedies with a view to their adaptation to the given conditions of this system, and to its power over the other functions in repressing congestion, spasm, inflammation, &c.—the facility in practice has been greatly heightened, and the evident success of the remedies adopted, has been equally encreased. He does not, however, attempt to lay claim to any credit of novelty or discovery in this work, only to the resuscitation of views long since propounded. In a work by *Eusebius Valli*, in 1793, it is stated that "Physicians have for a long time back observed that the Nervous System is first attacked by Disease."

The present Essay is also intended to draw the minds of Practitioners to the necessity of observing a true Physiological distinction between the Phenomena of the Nervous and Circulatory Systems. These are in modern works generally spoken of in such a loose, vague, and unphilosophical manner, as though they were parts of the same system and anatomical construction They are represented as organs possessing the same action, operated upon equally by the same influences, and represented as performing the same offices and functions—that it would seem as if it were high time some satisfactory conclusion should be established, as to which presents really the prior claim to the qualities of sensibility, transmission of impressions and disease—and the seat of conscious existence—*i. e.* the intervening medium between mind and matter.

Beheld in the light of Neuropathology, the Practitioner is not surprised at the sudden transfer and metastasis of disease—at the distant mischief which not unfrequently ensues from the serious affection of any important viscus—or at the occurrence of sympathetic pains, and affections—in parts at a considerable distance from the suffering organ. These often will be found to be the landmarks which direct, by experience, the eye of the Medical adviser to the original seat of the Disease. It is hoped that the attention of the Profession will ere long be drawn to the specially Nervous nature of the chief signs and symptoms of diseases—signs which as given by the Faculty, may almost at all times be referred to the manifestations of this system—especially such as refer to the phenomena of sensation—feeling of pain, variations of temperature—altered function, &c., which are indeed the chief symptoms related in human disease.

Should the present Essay be the means of arousing the Profession to any of these considerations, or of instigating the labourers in Medical Science to a deeper investigation of the Laws, Nature, and occult mysteries of Nervous phenomena—the labours of the Author will be abundantly rewarded.

SOUTHPORT, *October 7th*, 1854.

NERVE FORCE:

AN ENQUIRY INTO ITS ORIGIN, NATURE, USES, IMPORTANCE, AND FINAL DISSIPATION IN THE ANIMAL FRAME.

[*Read by* DR. GOODMAN, *before the Manchester Medical Society, Royal Institution, on Wednesday Evening, November 5th.* JOHN WINDSOR, ESQ., F.R.C.S., F.L.S., *in the Chair.*]

1. THE wisdom of the Divine Being is seen in creation. 'The invisible things of him, from the creation of the world, are clearly seen by the things that are made, even his eternal power and Godhead;' 'Day unto day uttereth speech; night unto night sheweth knowledge; There is no speech nor language where their voice is not heard.' But no where is His infinite wisdom manifested more than in the laws of reciprocal preservation of animal and vegetable life.

RESPIRATION.

2. The inhalation of oxygen, by animals, is vital to their existence; and therefore the Creator has made the vegetable kingdom subservient to their vitality. 'The growth and development of vegetables depend, under the influence of solar force to which all are subjected, "on the elimination of oxygen, which is separated from the other component parts of their nourishment," and diffused through the atmosphere continually in the day time, for the purpose of respiration by the animal kingdom. In return, the animal converts great part of the material, about to be discharged from his frame, into the form of oxides; which quickly become putrescent, and decay, and form a great source of vegetable nutrition.' Thus animals inspire from the atmosphere oxygen, in a gaseous form, combine with it, and diffuse it upon the roots of vegetables in the form of solid oxides. Vegetables absorb this material by their roots, appropriate to themselves the elements with which it is combined, and, ultimately, exhale tho same oxygen, in a gaseous form, prepared for the respiration of man.

NUTRITION.

3. Again, while no part of an organized being can serve as food to vegetables—until, by the process of putrefaction and decay, it has assumed the form of inorganic matter—the animal organism requires, for its nutrition, highly organized material. For the purpose of the nutrition of animals, the whole vegetable kingdom is continually at work, transforming and assimilating inorganic matter into its own growth and substance; and thus, in one vast laboratory, preparing food for man and beast.

VITAL FORCE.

4. Amid the ample fields of Nature which surround us, man has not failed to discover various forces which are found to perform the multifarious operations and movements of the external world. Light, Heat, Electricity, Magnetism, and Gravitation, are the names which he has applied to the chief of these various conditions of force. But although the greater part of these have been shown to be identical, and mutually convertible one into another, (see the labours of Franklin, Wallaston, Faraday, Melloni, Grove, and the Author of this paper, (especially in a paper presented this year to the Royal Society, establishing, it is believed, the perfect identity between the solar rays and voltaic force, and adding the last link to the chain of identity in the imponderable forces;) yet the force presiding over the vital functions of animals, appears to possess properties and peculiarities, which induce many physiologists to declare it, in the present state of our knowledge, a force, *sui generis.* The illustrious Liebig views the vital force 'as a cause of growth in the mass, and of resistance to those external agencies which tend to alter the form, structure, and composition of the substance in which the vital energy resides.' It further manifests itself as a cause of motion and change in the form and structure of material substances, disturbing the state

of rest of the chemical forces, holding together the elements of the food received by the living tissues, and causing a decomposition of the constituents of the food. It destroys the force of attraction excited between their molecules, and alters the direction of their chemical forces, so as to compel their constituents to arrange themselves in another form, and to combine to produce new compounds identical in composition with the living tissues, or differing from them, and assimilating the structures identical with its own tissue, to its own nutrition and growth.

The vital force is also manifested in the form of resistance, inasmuch as, by its presence in the living tissues, their elements acquire the power of withstanding the disturbance and change in their form and composition, which external agencies tend to produce; a power, which simply, as chemical compounds, they do not possess.

ORIGIN OF VITAL FORCE.

5. Liebig has shown that 'animal heat is derived from the absorption of oxygen and the consequent combustion and change of matter; and that, therefore, a rapid absorption of oxygen and change of matter produce the greatest amount of heat.'

The term change of matter, is applied to the waste or metamorphosis of tissues, which occurs by their union with oxygen, and consequent transformation into lifeless compounds, which are ejected ultimately as effete material.

6. He further shows that, however closely the conditions of the production of heat and force may seem connected together with reference to mechanical effects, yet the disengagement of heat can, in no way, be considered in itself as the cause of these effects. But that all experience, however, proves that there is in the organism only one source of mechanical power, and this source is the conversion of living parts, by oxygen, into lifeless amorphous compounds.

7. That in a given time an unlimited supply of oxygen cannot be introduced into the body; only a certain amount of living tissue lose the state of life, and only a limited amount of vital force can be manifested. That the sum of the mechanical force produced in a given time, is equal to the sum of force necessary, during the same time, to produce the voluntary and involuntary motions; *i.e.* all the force which the heart and intestines, etc., require for their several functions.

That the amount of mechanical force, manifested in a given time, is proportional to the amount of heat which is liberated, and to the amount of living matter, which in the body loses the condition of life. That the active force which is consumed in the body in causing increase of mass or growth, cannot, at the same time, be employed to produce mechanical effects.

8. That for the daily supply of force, a given amount of rest and repose is required, not for the accumulation of force, but for time required for the transformation of a given amount of elements, and for the expenditure of the vital force in causing the formation of new parts; and with the separation of the effete material, the organism recovers force equal to that which had been expended previously.

9. Professor Matteuci says, with regard to the origin of vital or nerve force, 'that whenever a movement occurs, or the effect of force is manifested, we are certain that some transformation of matter must have taken place.' 'That whenever a force is exerted, a chemical action precedes it. Caloric, electricity, and light, furnish us, at every instant, with evidence of this truth.'

'Muscular exercise,' says he, 'of whatever kind, is constantly followed by loss of power; and as we see the animal machine recover its aptitude for exercise after having obtained *food* and *rest*, we must admit, that the force necessary to muscular action, may arise from the chemical actions of nutrition, inasmuch, as by means of the latter and repose, this force is reproduced and accumulated in the nervous system.' After inquiring which, among the chemical actions that occur in animals, is the one that gives rise to the force, which is put in action during muscular contraction, he says, 'Of all the chemical actions of which the animal is the seat (322), the only one which we perfectly know, is that which produces carbonic acid. On the average, man converts and exhales in the form of carbonic acid 10 to 15 grammes of carbon per hour (324). We might, then, *consider all the chemical action of carbon, which combines with oxygen in animals, as the cause of nervous force*, independently of the heat and electricity that it may produce.

10. 'This nervous fluid enters continually into the nerves, and from them passes to the brain, assuming, in these bodies, a new state, which is no longer that of free fluid,' etc. 'It returns again from the brain towards the extremities by the act of the will.'

11. The electrician, Mr. Smee, contends for a central parenchyma or brain, a peripheral or body, the two being connected together by nerve fibre, and at both situations, and a proper supply of *arterial blood* as being necessary for the production of the phenomena of life. 'Thus the peculiar endowments of the brain are only manifested when blood is moving through its capillaries.' He quotes an experiment of the late Sir Astley Cooper, in which the four arteries, supplying the brain, were tied or compressed, and insensibility of the animal was the immediate result, which was as instantly removed, and the dog recovered his natural state on the readmission of the blood to the brain. Fainting, insensibility, and loss of muscular power, are also the immediate consequences of failure in the heart's action. Dr. Carpenter says:—'The due activity of these nervous centres is not only dependent upon a sufficient supply of blood, but it requires that this blood should be also in a state of extreme purity. For there is no tissue in the body, whose functions are so readily deranged by any departure from the regular standard in the circulating fluid, whether this consist in the *alteration* of the proportions of its *normal ingredients*, or in the introduction of *other substances*, which have no proper place in it.

'One of the most fertile sources of this disturbance in the action of the brain, consists in the retention of substances within the blood, which ought to be excreted from it. We see that three of the largest and most important organs in the body, the lungs, the liver, and the kidneys (and may we not add the skin), have it for their especial office to separate, from the circulating fluid, the product of decomposition which is continually taking place in the body; and thereby maintain its purity and fitness for its important functions.' Now if these from any cause even partially fail in their office, speedy disturbance of the functions of the *nervous centres* is the result. These results he goes on to particularize, showing how the functions of the brain are disturbed by carbonic acid, urea, etc., being retained in the blood, producing torpor, insensibility, and ultimately a complete cessation of the functions of this organ. This physiologist, however, says:—'Of the mode by which the effects of changes in one part of the nervous system, are thus instantaneously transmitted to another, nothing whatever is known.'

12. It is evident, therefore, that nerve force is not, as has long been considered, a force arising from the brain, by some mysterious and unintelligible process,* but from *true chemical decomposition*, the result of the *union of oxygen* with certain elements introduced into the blood. These nutritious elements may either be the new material, introduced into the body in the shape of food, or, during disease or starvation, the tissues and fat of the body, which are known to be removed at such periods.

11. It is probable that the circulation of fresh arterial blood to the brain and other centres is simply required, as it is, by a muscle for the preservation of life and excitability. We know that the heart soon ceases to beat, or a muscle to contract, when fresh arterial blood is not supplied; but the presence of blood is not the moving power by which contraction is effected.

It is well known this belongs alone to the nervous system.

14. With regard to the *source of nerve*

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* Dr. Hooper's *Vade Mecum*, by Dr. Guy, states that the sympathetic nerve is dependent for its supply of nervous power upon the brain and spinal cord, p. 56.

force, there is no doubt it is derived *primarily from respiration.*

15. When an individual is in a state of syncope, or fainting, if after we have removed the party into the open air, or set open a window, we can only, by sprinkling or dashing cold water upon the face and chest, induce a single gasp for breath, or respiratory movement, we find the individual rapidly returns to consciousness and vitality, and not till then. Every one is, moreover, familiar with the artificial measures employed for restoring a newborn fœtus, the smart blows, friction, artificial respiration, etc., which are employed to promote this function, and with each act of inspiration, how gradually, but perceptibly, does the heart's action augment, new vigour is manifested, and vitality is rapidly secured.

16. We are all familiar, likewise, with the effects of close, ill-ventilated, crowded rooms, rarified air in summer, and the deadly influence of carbonic acid gas upon the animal economy. How, in the former, delicate and sickly persons experience a sense of suffocation, faintness, nausea, loss of power, and ultimately swoon away; while, in the latter, many individuals lose their lives.

17. It is a known fact, likewise, that any individual can partake of, and digest, much more food, and with greater facility, in the pure air of the country, than in the dense, thick, and carbonized atmosphere of a large town. Let an individual with low vital powers eat a moderate amount of slightly indigestible food, in such an atmosphere as the latter, and he will not fail to be troubled with the usual signs of indigestion, pain, weight, flatulence, tumefaction, etc., while a meal of the same amount and kind in good air, may be borne at all times with perfect impunity.

18. The amount of nerve force possessed by any individual while remaining in the town, may also be readily contrasted with that derived from pure air, by the amount of labour which a delicate person is able to go through in either atmosphere. It is found that such an individual, usually residing in the country, and who can walk many miles without fatigue or injury in a pure atmosphere, flags and tires, and becomes exhausted, by walking a very few miles in the dense atmosphere of a manufacturing town.

19. It is also found that the pain and suffering of indigestion, the weariness and lassitude, spinal aching and exhaustion, are temporary results, experienced only during the inhalation of the noxious atmosphere, evincing that the nervous energy required for digestion, locomotion, etc., is derived directly from the inhalation of oxygen gas; and also that nervous force is not accumulated in advance, but obtainable only in the present tense, and is subject to rise or fall with the salubrity of the atmosphere in which an individual is located.

20. The chemical change which produces the nerve force, which is in continuous circulation through the nervous centres, is probably that which occurs in the pulmonary structure, by the union of oxygen with the elements of the blood, and is continually transmitted, by the pulmonary plexus, to the great nervous centres.

I have long endeavoured to exhibit a voltaic current, developed by the direct union of gaseous oxygen with a substance for which it has great affinity, but have hitherto failed. The nerve current may be also derived from the yielding up, by the arterial red globules, the superabundant oxygen which they contain, to the effete matters returning from their permanent vital condition as part of the frame, and thus communicate a constant current of nerve force to the extremities of the sensor nerves, and maintain, at all times during life, a continuous, conscious feeling of existence in every part of the frame; which feeling will be buoyant and energetic, or otherwise, in proportion to the energy and amount of chemical metamorphosis effected.

Exp.—Chemical action developes current.

Thus, by interposing a bladder diaphragm between two cells, one containing acid, and the other alkaly, a galvanometer, in communication by platina wires, with any part of the liquids in each cell, manifests current, and the evolution of carbonic acid gas takes place very beautifully and continuously on the side of the bladder, in contact with the alkaline solution.

A much more energetic current is produced by employing mercury on one side of the bladder, and nitric acid on the other. Here the oxidation of the mercury obtained at the expense of the nitric acid, which ultimately unite with the former, developes a considerable amount of current.

Exp.—But an experiment more resembling the union of effete material, or of the nutritious elements of the food with oxygen, is obtained by employing potassium on one side the diaphragm, and pure water on the other. Here a very energetic current of 35° to 40° is produced by the simple union of potassium with oxygen, which it seizes from the water, in the moistened bladder, and sets the hydrogen free.

21. Nerve force is also, to some extent, temporally augmented by other means. The exhibition of stimulants, which increase and invigorate the heart's action and the respiratory functions, and the internal and external application of cold water, the former of which will remove trembling of the limbs, headache, from exhaustion after remaining too long without food, the period for partaking of which it will protract for a considerable period.

I once saw an individual in Wales, who was at work at the bottom of a coal pit, when overflowed with water. He was obliged to retire to an elevated position in this subterraneous cavity, to avoid the more urgent alternative of being drowned, and remained in this situation twenty-seven or twenty-eight days, without any other substance than water, which he from time to time dropped into his mouth, from the tips of his fingers. He was found alive at the end of this period, was restored to his lamenting relatives, and lived many years afterwards.

NATURE OF THE NERVE FORCE.

22. There is evidently a strong analogy between the phenomena of nerve force, and of voltaic electricity.

They have clearly one common origin, viz., chemical action, and, as already seen, the union of oxygen with a base, or bases. They are both possessed of powers superior to chemical force, and the attraction of cohesion, and cause elements to form combinations antagonistic to chemical affinity.

They are found to travel along certain filaments, called nerves, in preference to other parts of the animal economy, and both are alike capable of developing, in these conducting filaments, certain sensations, each of the kind to which such nerve ministers—as that of taste, smell, sight, hearing, feeling, etc.

They are both equally capable of inducing contraction in muscular structures.

23. Dr. Wilson Philip has further shown, that there exists a striking analogy in the nervous and galvanic influences; and that the latter is capable of supplying entirely the place of the former, in performing the various functions of life. He having fed several rabbits with parsley, divided the eighth pair of nerves in some, for the purpose of ascertaining their influence in digestion. The breathing of these animals became more and more difficult, and eventually they died, suffocated.

On examining the contents of the stomach, the parsley had apparently undergone no change. Others were subjected to galvanic influence, by applying one wire to the nerve in an incision in the neck, and the other pole of the voltaic battery in front of the stomach; so that the electric current might pass through the digestive apparatus.

By this process, the difficulty of breathing was prevented for twenty-six hours; and the rabbits being killed when the current was discontinued, the parsley was found perfectly digested, and in the same state as that in the stomachs of other rabbits fed at the same time, and left unmolested in their natural and healthy condition.

These excellent electro-physiological results were subsequently confirmed by similar experiments conducted by other physiologists, which leave no doubt respecting the influence of galvanic force as a substitute in performing the nervous functions.

24. That there is a great analogy between this force and electricity, is further corroborated by the original experiments of Galvani. No doubt is left upon the minds of those who peruse an account of his experiments, that free electric fluid is a force as commonly developed by the structures of an animal when vitality is extinct, as by any ordinary voltaic arrangement. He has shown, that mere contact of dissimilar parts of an animal, such as muscle and nerve, are quite sufficient to disturb electrical force.

25. This class of experiments has also been undertaken afresh by Matteuci; and he has demonstrated, not only the truth of Galvani's experiments, etc., but has shown that there is constantly evolved from the *muscles of living animals* when in action, an electric current of no small importance. There are, however, several physiologists who oppose objections to the analogy of these forces. Thus, Dr. Carpenter, after enumerating several points of analogy—among which is included what we consider the strongest proof of all, viz. that certain animals, as the electric eel, torpedo, etc., *are capable of generating electrical force itself in a very remarkable manner; and the nervous system* (he admits) *is essentially concerned in this operation*—opposes the objection, that all attempts to procure manifestations of electric change in the state of the nerves, that are acting most energetically on muscles, have completely failed.

26. Professor Matteuci has, indeed, been the chief individual who has, with much skill and ingenuity, attempted to obtain manifestions of a transmitted current through the nerves upon a galvanometer, during their action on muscles. But we think Provost and Dumas, who also attempted this experiment without success, wisely concluded, that there are two galvanic currents in the nerves (in opposite directions), and which neutralize each other, and, hence, do not act upon the galvanometer. Vavaseur and Berandi have, however, asserted that needles passed through the nerves of living animals, become magnetic, so as to attract iron filings. Muller likewise states, that the unsuccessful experiments of Matteuci and others, afford no proof of the absence of electricity in the nerves—the instruments are too imperfect, etc.; but he opposes the objection, that the action of the *nerve-force* is *interrupted* by the ligature, or division of a nerve; while, if the poles of a galvanic apparatus be applied to a divided nerve, or to a nerve tied with a ligature, the *electric fluid* is transmitted as readily as before; and that the moist neurilema covering the nerves, would not insulate the nervous force, if it were like galvanic electricity; for this latter is conducted off from the nerves by other tissues, as readily as it is conducted by the nerves themselves; and so forth.

27. In answer to all these objections regarding conduction, I would remark, it is evident that many physiologists are not practical electricians, else they would be aware that ordinary electricity passes from the clouds to the earth sometimes a distance of some miles; that, the spark from a given number of pairs of voltaic combinations, is readily transmitted even through dry air; but that in general, a voltaic discharge is unable to make progress even through the unmoistened skin of the human hand.

That there are lower powers of this same force, which are able to traverse metallic conductors, but whose progress is instantly arrested by a drop of water, piece of muscle, or moist substance, which form such excellent conductors to voltaic force of a higher power. And there is one certain fact relative to nervous force—that its powers are so weak as to be inappreciable by the feelings, and yet to be retained within these same inconductible neurilemas, and still sufficiently effective to fulfil all the wants of the frame.

28. But we have a further proof of the identity of nerve force and electricity, in some very conclusive experiments, performed by the author of this paper last winter, as above mentioned — which go to show, that the solar beams have the same action in

inducing the deflexion of a magnetic needle in a galvanometer, as the voltaic current itself; and thus evincing the identity of heat and electricity:

If, therefore, heat is only a modification of electricity, the setting free of calorie in every operation of nerve force, as in the phenomena of electricity, must evince, that nerve force is also a modification of caloric and electricity; and we know, that heat is developed by muscular action, by digestion, by respiration, and even by *mental* labour.

It is also worthy of remark, that as stated by Liebig, 'the heat given off is always in proportion to the available force made use of by the frame, the amount of azotized matter consumed, and to the proportion of oxygen which enters into combination.

DIGESTION A VOLTAIC PROCESS.

29. There is, I would suggest, some reason for concluding that the whole process of digestion is not performed, as is commonly supposed, by the gastric juice, *but by a process identical with voltaic action.* On the one hand, we have, invariably, during the period of digestion, the mucous membrane of the stomach congested with vessels filled with fresh arterial blood, charged with free oxygen, and possessing decidedly a negative character. And, on the other hand, we have this viscus filled with electro-positive elements, and probably forming, with the former, a very efficient voltaic apparatus. Moreover, the food, it will be remembered, is changed chiefly at its surface; and, as layer after layer is assimilated, it is removed by the peculiar mechanical action of the muscular coating. Besides, the so-called gastric juice is uncertain and variable in its nature and quantity. It is found to vary in its powers in different animals: in some, to digest cartilage, and even bone; in others, only that kind of food upon which they ordinarily subsist. Its chemical characters are also variable, being found, at least, of different composition in different animals. And, even now, there is an uncertainty in the hands of the most eminent chemists, as to what is the chemical substance upon which its powers depend. In ordinary cases in man, it is slightly acidulated by acetic and muriatic acids, but very dilute muriatic acid, at the boiling point, dissolves the same substances; and in the dog, its acidity is said to depend upon the superphosphate of lime. We also find, that in many instances where an individual has eaten anything of an highly indigestible character, that stronger, or less, dilute acid is poured out to assist digestion, which is even discernible in the throat, and in the mouth of those thus affected.

30. Again, if acid were the solvent in gastric juice, we should have, in all cases, the greatest amount of this where digestive energy is most potent, and where the individual is possessed of the greatest strength or intensity of nerve force.

But we find the very reverse of this is the fact, for those in whom the vital powers are at the lowest ebb, generally secrete the greatest amount of acid; and so much so, that the mere drinking of water, and the lodgment of the most digestible substance in their stomach, provokes an instant flow of acidity.

But, if the source of galvanic agency be cut off by dividing the eighth pair of nerves, although there might have been much gastric fluid, or pepsine, in the stomach, when this was done, yet no digestive process goes forward.

31. Gentlemen, there needs but one very simple experiment to decide this question. Let the gastric fluid be obtained first, by the introduction of a sponge within a tube into the stomach; let the eighth pair of nerves be then divided, and then introduce food, mixed with gastric juice, into the stomach—feeding also another animal in which the same conditions have been observed, with the exception of the division of the nerve—and if digestion fails in the former, but not in the latter, digestion is (by a few repetitions of the same thing) established, at least as a process analogical with galvanism. There is also another circumstance that corroborates this opinion, viz. that if a delicate individual (a dyspeptic), after eating an ordinary meal, which he knows he can easily digest, instantly starts off, *and removes a large portion of*

nervous force by violent exertion—he immediately detects acid in the stomach by the usual signs; showing, that the *deprivation of nerve force renders the secretion of an acid necessary to digestion*, and places the stomach in the condition of that of the veriest dyspeptic; showing, that *acidity is, in some measure, a substitute for nerve force.*

32. There is one experiment which I discovered a little while ago, which shows to some extent, that one action of the nerves—the sensation of taste—is galvanic. If a portion of sugar, or other moistened substances—acid, alkaline, sweet, or stimulant, etc.—be placed upon the tongue, whilst it has no communication with the lips or palate, (the palatine branches off the naso-palatine nerve, etc.) no taste is discoverable; for if the party has his eyes blindfolded, he is utterly unable to tell you which of these substances it is—the consistence of each being alike.

This is well known to be a necessary condition of all voltaic phenomena; for no galvanic action can result, without the pre-existence and completion of an electrical circuit.

33. *Conclusions.*—Many of the above facts are becoming daily more and more familiar to the medical eye, and it is now beginning to be assumed as an axiom, that every individual possesses a certain positive, and only a certain, amount of vital energy, which he can, with impunity, employ for any given object or objects. It is found that if he employ more force than is derivable from the amount of food taken—more than is equivalent to his ordinary strength—or has made use of stimulants to fetch out more labour than is the natural product of his frame, a corresponding suffering, and loss of power and substance, will follow, in proportion to the excess of labour.

If the nerve force is expended in mental occupations, the ordinary energy for muscular toil, and the functions of the viscera, is found to be deficient. If a given amount of nerve force is expended in inordinate digestion of food, improper in quantity or quality, a corresponding sluggishness of action of all the other powers is speedily discerned. Quantitative chemistry indeed, as propounded by the illustrious Liebig, will admit of no expenditure with impunity of any power in the frame, beyond what is ordinarily derivable from the amount of oxygen inhaled, of the food taken, or of living elements metamorphosed into lifeless and effete material.

34. Among other causes of exhaustion of nerve force, we may remark that grief, joy, the passions, mental excitement of any kind, intense thought and study, starvation, loss of rest and sleep, heavy discharges, etc., deprive the mechanical powers of much of their wonted energy, the stomach of its digestive power, and nutrition of its claims.

Of the special causes in the present day, not a little may be said of the care, anxiety, and speculative genius which engender so many aching heads and broken hearts, and rob the system for years of an amount of nervous energy; which can only be atoned for by a long period of dragging existence, or, as frequently occurs, by the alone extinction of this state of mind in the stillness of the tomb.

35. Exhaustion of nervous energy is accompanied by tremblings, diminished or totally extinct secretions and dry membranes, or there may be pain, faintings, dimness of sight, tinnitus aurium, prostrate muscular power, remarkably quick pulse, frequent flushes of heat, cold extremities, loss of consciousness, delirium, or other symptoms, commonly denominated 'nervous.'

36. The extreme prostration of the vital powers is effected momentarily—as by a flash of lightning—in all cases of terrific injury, by the instantaneous crushing of a whole limb, severe lacerations by machinery, amputation by the wheels of a railway train (as in the case of the lamented Mr. Huskisson), by very extensive burns and scalds, in some cases of cholera, and even by intense impressions suddenly made upon the mind, etc. From many of these, nature sinks no more to rise.

37. *The existing amount of nervous energy becomes, therefore, a subject of serious and diligent inquiry by the medical practitioner.* Numbers of cases of summer and autumnal *typhus* may

be attributed to its deficiency; expenditure of nervous force by excessive perspiration and diarrhœa; by exhausting fever of any kind; by ordinary labour and toil during the prevalence of considerable rarefaction of the air in hot weather, and the corresponding loss of appetite which accompanies excessive heat, will form a vast source of the typhoid type of disease.

Diseases are also found to assume this type, in like manner, from close, crowded, heated, and ill-ventilated apartments, whether hospitals or common dwellings.

The attempt to employ much exercise during the early period of convalescence from any of these maladies, whilst the powers of life are at so low an ebb, as is commonly observed, only removes vital energy by those parts of the frame where it is not desirable, and at the expense of the functions of vital organs, whose efficient labour can alone secure a return to health and strength.

38. It is no wonder to hear persons of a delicate habit and constitution, incessantly complaining of loss of digestive power and constipation, who are continually taxing the powers of their weakly nervous system with over-exertion, mental fatigue, loss of rest (turning, indeed, night into day, and day into night), the excitements of the table, and the gaieties of life, and loading the already imbecile digestive canal with an abundance of strange indigestibles and irritants, which would soon prostrate the like apparatus of the most vigorous and athletic frame.

The aperient draught, or pill, becomes one of the necessaries of life; the potency or quantity has daily to be augmented; and nerve force being subservient to the law, that *over-stimulation is always followed by corresponding depression*, each additional dose constantly increases the imbecility of the bowels, not only of their long irritated mucous and secretorial membrane, but also of their muscular tunic, by which alone the peristaltic motion can be carried on. So that, ultimately, no evacuation can be procured, except by this unnatural mode of purgation. The doses of mercury prescribed in this state of affairs, to establish already lost and paralized secretive function, are pregnant with results terrific to contemplate. Hygiene, accompanied by a judicious application of hydropathy, can alone remedy this sad state of affairs.

IMPORTANCE.

39. The importance of nerve force in the animal economy is seen, in that it is the inducing cause, and the presiding influence, over secretion and excretion. Upon it depend digestion, and the assimilation of food; and as it presides over the circulation of the blood, it becomes the power by which that food is introduced into the stomach. Again: the removal of excrement is an operation also of involuntary vital force, as well as the elimination of the elements of bile, urine, perspiration, etc.; all which latter must be removed in order to the circulation of healthy blood, and, by it, to the building up of the frame by good, sound, and healthy material, such as shall withstand the mishaps and ills of time, the changes of temperature, blast and storm; and, at length, pay its last tribute to mortality, when old age, hoary hairs, and second childhood forbid its longer residence in this sublunary vale.

40. The further importance of this force is also shown by Professor Liebig, when he says, 'We know with certainty, that the nerves are the conductors and propagators of mechanical effects. We know that, by means of them, motion is propagated in all directions. By means of the nerves, all the parts of the body receive the moving force, which is indispensable to their functions. *Where nerves are not found, motion does not occur.*'

'The excess of force generated in one place, is conducted to other parts by the nerves; and the force which one organ cannot produce in itself, is conveyed to it from other quarters, by the nerves.'

41. Nerve force is also important, inasmuch as it forms the connecting medium between man and the external world, the telegraphic medium by which the various forms, colour, distances, dimensions, nature, etc., of objects are conveyed to the mind—by which every joyful in-

telligence, every sorrowful feeling, every pleasurable or painful sensation is received—by which, indeed, every transaction with matter is telegraphed in the domain of consciousness, or registered in the emporium of memory.

We do not intend to confound things that differ—differ essentially—differ eternally. Nerve force is not the immortal soul. It is the animal spirit, the handmaid, the medium by which the soul transacts the business of life. But we would say, let there be vital force, and man lives—let it be extinguished, and he expires.

42. Its importance is still further seen, in that it is solely by the agency of the vital principle, or nervous energy, that the cure of disease is effected. When vital force is expended, all curative agency is at an end.

Medical gentlemen may sometimes so far forget the nature of the frame, and the valuable physiological lessons that they have received—both as students and afterwards at the bedside of the invalid—as to attribute the healing of a sore, or the removal of a malady, to the powers and virtues of the medicine prescribed; or, in the hurry of professional life, attribute the loss of a patient to the absence of some ingredient, omitted in a given prescription; but, in reality, the whole recovery from disease, or loss of the patient, must, in truth, be imputed to the powers and conditions of the vital force.

Medicine may control, direct, curb, or spur onward this swift steed of vitality; but it is the vital force alone that can conduct the frame to its ultimate termination.

Let this be wrong, and the whole man is wrong; excited, and the whole system suffers from its excitement.

Is there pain? pain is nowhere felt, produced, or appreciated by the mind, but only by, and in, the nervous structure. *Flesh, artery, membrane, bone, sinew, abstractedly from nervous structure, can no more feel or transmit pain, disease, or excitement, than can the stump of a tree, or any other lifeless or inorganic matter.*

FINAL DISSIPATION.

43. Liebeg remarks, that 'only at a given temperature is nerve force developed —below this temperature, life ceases.'

May we not reverse the order of this statement, and say, that vital force is the source of temperature; that it is nowhere in action without an amount of heat being given off, proportionate to such action; that it is, indeed, the *dissipation of this nerve force itself, after it has performed the various functions of the body*, which, by its convertibility into radiant heat, so admirably sustains the constantly exhausting temperature of the frame; and that where nerve force ceases to be developed, and the functions of the frame to be performed, heat also ceases to be given off.

After some discussion,

The thanks of the society were proposed, seconded, and voted unanimously, to Dr. Goodman, for his interesting and elaborate paper, and the meeting terminated.

NEUROPATHOLOGY:

OR, NERVE DISORDER THE BASIS OF ALL MORBID ACTION.

[*Read by* JOHN GOODMAN, M.D., M.R.C.S., *at a Meeting of the Manchester Medical Society, held in the Royal Institution, Mosely Street, December 3rd,* 1851. T. CATLOW, ESQ., *occupying the Chair.*]

44. All physiological action in the animal economy derives its origin in the nervous system.

We have already seen that the nervous system is more especially connected with the vital principle than any other part of the animal economy, and is commonly admitted to be the seat of nerve force.

As the material man forms the subject of contemplation in this essay, the mind, or soul, is viewed only in the light of an external agent, although influencing, to a vast extent, the health of the frame.

NERVE INFLUENCE UPON THE CIRCULATION.

45. That the nerves have special control over the functions of the heart, arterial and capillary structures of the body, may be seen, in that the emotion of shame causes the cheek to blush, while the emotion of fear, pain, terror, etc., blanches it. The effect of the emotions and passions, and of all violent exertions of the body on the heart, is a matter of daily observation ; and so surely does the circulation participate in every change of the nervous system, that it becomes the best test of the degree and amount of that change. All stimuli, as food, drink, mental application, the excitement of waking hours, etc. etc., produce an effect upon the circulation, which is greater in the morning than at night. After fatigue, the pulse falls towards evening, and regains its frequency when the body is refreshed by sleep.

The state of the pulse forms, therefore, a most valuable indicator of nerve force, and of the strength and powers of the constitution.

THE INFLUENCE OF NERVE FORCE ON EXCRETION, SECRETION, EGESTION, ETC.

46. Professor Müller states in his physiological work (p. 630), 'that in cases that are not febrile, a sudden withdrawal of nervous energy, such as takes place in syncope, and during the sway of the depressing passions, gives rise to a profuse cold sweat.' And 'in febrile affections, the secretion of the skin and mucous membranes diminishes in proportion as the influence of the nervous system in these parts is depressed.' That these conditions of the skin—flushes of heat, chills, cold sweats, etc.—are dependent frequently upon *emotions of the mind,* is a fact of every-day observation. That the nerves have also a great effect on the secretions, is seen in the flow of tears from grief, joy, etc., and in effects of anxiety or fear upon the skin, kidneys, or bowels.

Mental emotion, likewise, checks some of the secretions. Thus fear, which increases the secretion of the skin, checks that of the salivary glands, and the mouth becomes dry and parched.

It is sometimes noticed in peculiar cases, that during excitement of the mind by study, invention, etc., the urinary organs are affected, and no new object can be pursued until relief has been obtained.

There are other cases where fear of an impending examination acts severely upon these organs, as is well known to a certain class of students. In other cases, the bowels are affected, and fear induces a sure attack of diarrhœa. In others, the sympathetic action takes place in the kidneys, heart, respiratory organs, bowels, or uterus, etc., from the reception of news of an unpleasant and affecting character. Cases of this kind are of daily occurence, and some in which loss of life has been the result.

47. The stomach is very speedily affected to vomiting, by the delineation of a loathsome or affecting sight upon the retina. The sight of blood will, in many instances, produce nausea, vomitting, and even faintness.

This organ is also severely affected to nausea, or vomiting, by any intense pain, or violent lesion, etc., of any part of the body, as concussion of the brain, violent contusions, inflammation of vital organs, or, indeed, any pain arising from the organic centres.

The well-known phenomena of sympathy excited by gaping, smiling, moroseness, and other expressive features of the countenance, well illustrate this nervous action.

48. It is worthy of notice here, that nerve is the primary structure which is developed in the animal economy.

'The parts first formed in the embryo of vertebrated animals are, the spinal cord, and the vertebral column, which forms its protecting wall' (812, Carpenter's *Physiology*); evincing that nerve structure is necessary to the development of animal tissue, and the basis of independent animal existence.

49. LOSS OF FUNCTION AFTER INJURY OF NERVE STRUCTURE.

If the nervous system, or any part of it, is destroyed, either the ordinary signs of consciousness, feeling, or muscular motion are annihilated, or the several functions of life, or vitality in that part, which such system or nerve supplies. If the nerve be one of sensation, irritation of the trunk or branches of the nerve below the point of injury or division, causes no pain; if it be one of voluntary motion, neither the operation of the will, nor a stimulus applied to it above the point of division or injury, can cause the muscle to which it is distributed, to contract. It is also discovered, that if the nerves of organic life are injured or destroyed, in whole or in part, whether it be by the intense cold of a Lapland region, the effects of poisonous matter introduced into the constitution, or the failure of the vital powers themselves, that every part supplied by such injured nerves, forthwith puts on the condition of gangrene, and sphacelus, and, becoming utterly lifeless, is in general removed by Nature's own amputatory process from the constitution.

50. The nervous system has (as we are all aware) of late, by the important discoveries of Dr. Marshall Hall, and others, been exhibited as comprehending three great centres, or systems —the cerebral, the spinal, and the ganglionic.

The first, or cerebral, includes the human brain, with all its faculties and powers, the nerves of sensation, and all those of voluntary motion which derive their origin from the cerebrum and cerebellum, where it is generally believed the mind and reasoning powers, or the intellectual part of man, has its seat.

51. The second division includes the true spinal marrow, which is chiefly occupied by three sets of nerves, the sentient, the *excito motor* nerves of the involuntary muscles, subservient to ingestion and egestion; *i.e.* the introduction of food, and the removal of the evacuations and the voluntary motor nerves.

52. The third class comprehends the ganglionic system, which presides over the functions of animal life, secretion, excretion, and nutrition, as well as the more important actions of the vital organs of the heart and respiratory organs, the stomach, liver, intestines, kidneys, and even the nutrition and development of the brain itself.

Indeed, wherever there are organs in the body, or wherever nutrition goes on in it, there are nerves of nutrition to be found. The point of the finest needle cannot be introduced into any tissue of the frame, without entering one or more of the capillaries, or blood vessels, and organic nerves.

53. Injury to the *first class* of nerves destroys the power of thought, consciousness, perception, sensation, etc.; of the *second class*, the capability of taking in food and drink, and atmospheric air for respiration, or of expelling the various excrements of the body; while injury to the *third class destroys function, organization, and vitality itself.*

54. Subservient to its influence, the nervous system supplies various organs, called muscles, which act upon certain orifices, tubes, and other apparatus, so as to serve for the introduction of all required materials for nutrition and respiration. It also supplies and *influences* certain appropriate organs with power to elaborate and purify the nutritive elements, and produces the movement of the circulatory apparatus for its dis-

tribution and deposit, as well as for the removal of effete material, and its final ejectment from the frame. Endowed also by these same telegraphic filaments are the various organs of sense, the indicators of sight, sound, feeling, touch, etc.; and the organs for the perception of the various properties and qualities of matter, etc.

In addition to these, there are also certain levers designed for the production of the various mechanical motions of the frame, which are clothed with muscular structure and *moved by nervous influence*, for the performance of locomotion, mechanical effort, and all the multifarious operations of human life.

Encase the important viscera of this machine, so 'fearfully and wonderfully made,' in a bony fabric for accommodation, support, and protection; and *enclose the whole*, both externally and internally, in *one diffuse expanse and beautiful network of nervous armour* for its protection from injury, deliverance from danger, the choice of its elements of nutrition, and the exclusion of noxious material, and you have the mysterious, admirable, and wonderful being, Man!

It is in *this view of man* that we intend to study his various diseases in the following essay.

55. *Thus we see, that the momentuously important and deeply interesting actions and phenomena of the whole animal economy, are dependent upon the nervous system for their development and existence; and we cannot help beholding the whole animal mechanism and fabric of man, as one conscious, intelligent, sensitive, moving and living mass of nerve.*

56. The nervous armour by which man and animals are enveloped, is particularly observable at the various orifices or inlets of the body; and *there is no inlet to the interior of the frame that is not protected by highly sensitive nervous tissue.*

The eyelids are guarded by projecting lashes or feelers, which give instant intimation of the approach of foreign bodies, and the movements of the lids themselves are almost swift as lightning, to exclude projectile or floating bodies, of whose approach the lashes have given intimation, as well as all noxious effluvia and gases from contact with the delicate structure of the eye.

57. The usual way of access to the mass of fluids of the body is by the mouth into the alimentary canal, or by the nostrils, larynx, and wind-pipe, into the pulmonary cells.

Now, in the inferior animals, the former inlet, the mouth, is particularly guarded by the instinctive powers of the olfactory nerves, situate at he entrance to the nostrils, and by a similar discriminative capacity in the lips themselves; and in man, in his primitive simplicity and original condition, no doubt high faculties of discernment of the noxious or beneficial qualities of food was primarily possessed. The palate—now a source of such vast injury to the well-being of man—there is much reason to believe was, at that period, possessed of exalted instinctive powers for the rejection of injurious aliments from the first passages.

There is, further, a highly sensitive and instinctive power still remaining in mankind for the rejection of food by the stomach itself, either where this is injurious in quality or quantity; and, lastly, the very mouths of the lacteals themselves, which supply all the nourishing materials to the blood which it receives, are furnished with an instinctive and detective apparatus for the rejection of irritants and noxious matter and for the absorption of all good nourishing materials; so that, in the natural and simple condition of man, no injurious element can, by possibility, be received into the mass of blood without previous disorganization of tissue, or destruction of the natural susceptibility of nerve.

58. In order to prevent the introduction of morbid or poisonous elements, or gases, into the blood by the organs of respiration, there is, first, the instinctive power resident in the olfactory nerves (nerves of smell), which give intimation of the vicinity of all odoriferous, noxious particles.

Excited by these organs, is the repulsive action, ordinarily termed 'sneezing,' by the agency of which, minute foreign particles are readily rejected from the interior of this apparatus. Still further inwards, at the entrance to the trachea (wind-pipe), there is situate, at the opening into the larynx, an admirable contrivance, in the form of a highly sensitive valve, whose office is to prevent the ingress of liquids and solids of every description, and to exclude all noxious gases and vapours from penetrating into the interior of the lungs; and the efficiency of this contrivance is still further augmented by the excitation of 'cough,' which is induced by irritation, not only of this sensitive valve, but of the whole extent of membrane forming the interior of the trachea and pulmonary organs. It is further remarkable, that there is not a known organ located in the whole frame for secretion, excretion, or exhalation, where a direct pervious channel can be discovered. Modern microscopists have discovered that the little tubuli of the organs, in every apparatus of this kind, terminate, invariably, in what is termed a cul de sac, or blind head, in which the distillation of the secretion is carried on through the simple pores of a distinct membrane.

This is also the case with the air cells of the lungs themselves, which are formed of distinct membrane-like bladder, which separates the atmospheric air from the blood, prevents direct contact, and permits the accomplishment of their important chemical union alone through the medium of the membrane.

59. It is tolerably obvious also, that, although the skin is a veritable secernent organ, its structure is furnished with similar instinctive and rejective powers. For although there is no exhalent orifice situate in this organ which does not form in the interior a blind cul de sac, as before described, yet there are here evident signs of both sensibility and exclusive agency.

The sensibility and contractile powers of the skin are witnessed in the instant contraction of this organ, which becomes as goose flesh under the influence of cold.

How susceptible is it in delicate persons, in whom even ordinary influences and atmospheric changes would constantly prove injurious; and how completely are its exhalents closed up by the irritation of the nerves in fever and in inflammation, or during the application, even in health, of irritants to the surface of the skin, such as the astringents, dilute mineral acids, etc.

Notice the wonderful capability of exclusive power in the tissues of the skin and mucous membranes, whilst retaining their integrity of structure. It is a well known fact, that the most virulent poisons, as the morbid matter of the dissecting room, the virus of inoculation, or even that of a rabid animal, take no effect even by remaining sometime upon the surface of the skin, while the cuticle is entire; but the slightest abrasion is frequently attended by the most calamitous results. The coats of the stomach, and other parts of the mucous membrane, are also known to resist the ingress of virus into the mass of blood. Thus history details the remarkable manner in which Eleanor abstracted the poison by her own lips from her husband's wounds, as it is stated, 'to save his life at the hazard of her own.' Medical men continually avail themselves of this method of self-preservation, both in the dissecting room and at post mortem examinations, etc.

60. Thus has the Giver of all good so wisely and benevolently endowed the frame of man for the purpose of choosing, or refusing, amid the various elements of nutrition and respiration presented for his support.

There is little doubt, as we before remarked, that man in his original simplicity possessed, besides the high intellectual and discerning qualities of his mental faculties, considerable instinctive power in the selection of his food, until instinct was destroyed or depraved by luxurious and artificial indulgences, primarily offensive to his better judgment and instinctive perceptions.

But even now a given course of life, including the partaking of simple food, water as a beverage, and the exclusion of all stimulants and artificial nutrition, will soon bring back many of these original powers of his nature, and render active many that are already dormant.

'Why' (says a late writer) 'does the new-born infant *whimper for its mother's* *breast?* Or why are the smell and taste of *all poisons*, unmixed with well-tasted substances, repugnant and unpleasant to the man of nature? We are told that even the savage spits out, or, at *least*, *swallows with reluctance and disgust*, the first mouthful of intoxicating liquor. It is the voice of Instinct, in Nature, which is the voice of God!'

We see, then, that as there is no other medium of access to the blood but by the various protected inlets to the body, no noxious matter can be expected to penetrate into the mass of fluids, or become deposited in the more solid structures of the frame, without the consent of these sentinel orifices of the nervous system.

61. PECULIAR CHARACTERISTICS OF THE GANGLIONIC SYSTEM.

There is no part of the animal economy so important, and yet none that has received so little attention, as the great sympathetic system. Professor Matteuci has shewn, that the difference of action exercised by the (voltaic) current upon the nerves of relation, and on those of organic life, is very marked.

In the former, its effects are manifested only in the first and last moments of its application; in the latter, on the contrary, they are *slow to appear*, *continue during the passage of the current, and even persist after it has been interrupted.* 'For the little that we know (says he) on this subject, we are indebted to the celebrated Humboldt.'

When we transmit a current through the heart of a recently killed animal, a few instants after pulsations have ceased, we observe that this organ recovers its usual movements some time after the passage of the electric current; and that these movements are preserved *for a certain time after the organ has been withdrawn from the action of the current.* The same action takes place when the natural movements of the heart are becoming weaker. After a *time* they become more frequent, and the *augmented frequency continues for several seconds after the current has been interrupted.*

Like effects take place also with the vermicular movements of the intestines, when these organs are subjected to the influence of the current.

From long-continued observation upon the action of the ganglionic system in disease, although at that time unacquainted with these laws of the organic nerves, I have traced, in those supplying the various canals and organs of the body, an identical mode of action.

Thus, in individuals who possess a highly sensitive condition of these organic centres, a complaint, which I find to be by no means uncommon (see 109, 110, 111, etc.), after a portion of irritating substance had been eaten on a given day, the effects of irritation began to come on gradually, and only to be fully manifested on the third day; when they would *gradually increase, although no further irritant was indulged in, from a period of from one to three weeks.*

In some instances, where the irritant was continued, the effects have come on imperceptibly at first, *and have continued fiercely augmenting for a much longer period.* Indeed, these nerves possess so little power of sensation, that no pain is felt for a considerable period, and irritation may be fostered and encouraged for years, which it is in many instances, and even for whole lives; and the individual may die a martyr to its effects, without either the patient or the medical adviser being at all aware of the progress of the malady, or the nature of the disease existing. The author whom I have just quoted, says: 'If we reflect upon the importance which the ganglionic system possesses in the performance of the organic functions of animals, we can readily understand how very insufficient are the researches hitherto made on this subject.'

62. Idiopathic irritiation of the ganglions themselves, which supply the intestines, differs from all the varieties of mucous disease, and is known sometimes by the ordinary signs of abdominal pain arising in cases of what are termed tender bowels, or sometimes by a peculiarly pungent sensation like the pricking of needles, where no sign of dysenteric action—gastro enterité—or inflammatory affection of the mucous surface, at all prevails, but generally the

universal implication of the viscera. If there be discharge, that discharge is simply mucus. It may be like the secretion from the nasal passages, thick, opaque, white, yellow, or transparent—or even present the characters of almost solid, gelatinous matter; but unless the mucous membrane becomes the seat of the disease, or is highly implicated, there is no discharge of either lymph, pus, or sanguineous fluid. The discharge is also of the same character, when the ganglia supplying the bronchi, larynx, or urethra, are affected. In the former case, it is what the ordinary practitioner terms the expectoration from 'nervous cough.'

When the gastric ganglia are affected, my experience goes to shew, that without any symptom of an inflammatory condition of the mucous membrane of the stomach, there shall be profuse flatulence, gastrodynia, sense of weight after partaking of any ordinary indigestible substance, and all the usual signs of dyspepsia; but the very medicinal remedies which give relief to these symptoms in other cases, especially to flatulence, such as stimulants, æthers, the fetid and stimulant gums, and the ordinary carminatives, only add more intensely to tho symptoms, and produce an extraordinary effusion of flatus.

This state of things is frequently discovered in old and long-continued cases of dyspepsia, where the centres have become the seat of disease.

In all these instances of affections of the sympathetic system during tho presence of severe irritation, there will be also acute muscular spasmodic effort, or straining in accordance with the locality of the organ supplied by the irritated nerve, as spasmodic cough in the affections of the bronchi; spasm of the stomach; constriction of the intestines; strangury of the urinary organs; or tenesmus of the rectum; in affections of the centres supplying these various organs: and many are the instances in which the entire nervous centres are affected, where we have an accompanying implication of the whole abdominal and thoracic viscera.

63. We believe that *the laws of prolonged and gradually increasing action of the sympathetic system*, instanced above, *may be regarded as the basis of many mysterious and otherwise unaccountable continued fevers;* and where the known cause of fever has been but of very transitory continuance; *and, indeed, as the great sympathetic nerves preside over all vascular action, it appears to bear considerably upon the phenomena of all febrile disease and inflammatory action whatsoever.*

64. It is worthy of remark, that there are found in medical practice few diseases of long *standing in which the nervous centres* have not become implicated and shattered, and in which they may not be referred to as *the ultimate source of chronic disease*, through which gradually *all* the viscera, and the various functions of the body, become encreasingly disabled, and the phenomena of vitality gradually sapped and destroyed.

It is up to the period of *implication of these great centres* of life, that medicine can be borne, and appears to be of temporary utility; but after this change, all wise and conscientious practitioners are observed to discontinue their medicinal prescriptions, and resort to Hygiene.

65. In all instances of nerve affection, there appears to be a vast distinction generally between the phenomena of morbid condition of surface, and that of a centre or trunk of the nervous system—between affections of the diffuse expanse of nervous tissue interwoven with the lamina of mucous or serous membrane or skin, and those which occupy the head quarters or interior of the very centres themselves.

In the former, we may have high inflammatory action, violent eruptive and inflammatory fever, and acute attacks of various kinds prevailing—indeed, all such diseases as occupy a plethoric or unshaken constitution. In the latter, we have no morbid affections but such as occur during the existence of shattered nerves in dilapidated constitutions existing with diminished vital energy or nerve force, or, at all events, with that amount of irritability of the great centres of life commonly called "nervousness."

66. NERVE DISORDER THE BASIS OF DISEASE.

Viewed in the light of these facts and discoveries, the animal economy cannot fail to impress us with the great truth, that nerve is the part of the frame which is primarily affected in disease. It has ever been deemed a matter of the highest importance to obtain correct views of the true origin of disease in the human frame, and therefore medical science has introduced many theories upon this subject; but the chief hypotheses that have stood their ground since the time of Hippocrates, are the opinions of the Solidists and the Humoralists.

67. With regard to the former, if the Solidist holds any alteration as taking place in these structures in which the nervous system is not, or has not, been implicated, the facts that we have just advanced utterly deny such condition. That there may be existing in the solid structures of the body the most intensely powerful elements of virulent and destructive disease, we do not dispute; but we contend, that the *solids themselves are only depositions under the immediate control of nervous influence* (46), and that there must have been the same irritation set up during the deposition of morbid materials in the frame, that ensues during the indication of their presence or their removal afterwards, unless they were laid down during embryonic development by hereditary deposition. *That as long as the nervous system is undisturbed by their presence, there will be no signs of diseased action, nor any morbid alteration in the general health of the frame.*

68. That there is no connecting link of communication between phenomena of daily observation. How much soever two distant parts or organs may, during life, suffer from corresponding, sympathetic, and reciprocal maladies, *there exists no known intervening anatomical medium between such diseased parts, except the nervous system*, and, after death, there remain no signs or trace of morbid continuity; for, as we have before observed (42), flesh, artery, membrane, bone, sinew, abstractedly from nervous structure, can no more transmit disease, pain, etc. than the stump of a tree.

69. If, on the other hand, the morbid state of the fluids is maintained by any theorist as the primary cause of disease, apart from nervous influence both in its introduction into the blood and action upon the frame, the facts before enumerated give a negative to any such assumption (56). We contend, that the morbid condition of the blood itself is, *in general*, the production of the direct action of nerve force. But if, nevertheless, morbid matter has been admitted, as it frequently is in the present condition of mankind, through the respiratory, absorbent, alimentary, or secernent organs, we still maintain, that no such introduction can ensue *without the permission of the nervous system.*

That, in such instances, a degree of *torpor and want of susceptibility* is evidenced on the part of the latter, inconsistent with the laws of instinct, or the due irritability of healthy function; and that, therefore, to defend the frame from the influence of pestilential effluvia, malaria, cholera, and infectious disease, the only secure protective remedy, is to preserve the integrity and healthy condition of the nervous system, at least, by nutritious and inoffensive diet, temperate living, salubrious air, appropriate exercise, and cleanliness; and if needful, the use of such measures and adjuvants as are presented in a judicious course of bathing. That, in general, the primary introduction of morbid elements of any kind into the frame, is marked by some perceptible degree of morbid action, unless the nerve function is depraved or otherwise engaged by the irritation of some previously existing sore, abrasion, or ulcer, by which morbid matter is indeed often conveyed into the system; and even, in this instance, the introduction of virus is generally abundantly evinced by irritative febrile action. But the whole difficulty is removed, if we behold the mass of blood, when morbid, as an irritant of the nervous system, and affecting its condition simply, as do all other external noxious agents.

70. But a slight survey of the characters, changes, and functions of the

blood, must satisfy us that the basis of disease cannot here be anticipated. A fluid, to which fresh accessions are so continuously made in the twenty-four hours, a portion of which has to be sixty times every minute passed through the circulatory centres, and transmitted through the vessels of the air cells to receive new life and new vigour.

A fluid, which is constantly losing by excretion, not only aqueous and saline portions of its nature, but the more solid and durable parts of its composition by nutritious deposition. A fluid, which is continually and arduously engaged in withdrawing old effete materials, removing them from the body, and replacing them with new matter; building up, vivifying, renewing, pulling down, carrying away, and ejecting from the body.—Upon such a shifting, changeable, moving mass, how improbable is it that any permanent basis of disease can be erected? Again: in all cases we believe that the greater part of all noxious matters, with the exception of those of a narcotic kind, are irritants; that no irritant can remain, in admixture with the blood, exposed and in contact with the living molecules of any part of the frame, without being in contact with nerve fibre (51); and, therefore, that this contact will instantly telegraph excitation to the great nervous centres, and produce morbid action either in the nerves, muscles, or vascular system, which will become manifest, unless the extreme dilution of the virus renders its effects inappreciable.

But let it be admitted that there is morbid or poisonous matter in the mass of fluids, and that they have gained admission during the sleep of the centinels—for it is certain we often find such to be the case in the present constituted state of the human frame—well, after all this, they cannot affect the functions of life save through the nervous system. It is but still a form of irritant external to the nervous system among many others.

The very moment that this begins to assume a sufficiently powerful character to irritate the nerves arranged in the structure of the vascular tunic, that moment will the nervous system evince signs of excited action, ultimately telegraphed by them to other filaments, to the muscles, or to the circulation, the pulse, and all the viscera of the frame. Its *action* may, however, be discovered in depression quite as certainly as in reaction; and probably it is this state of affairs which keeps the vital energy of some, who are affected with the scropulous diathesis, or latent syphilis, continually in a state of depressed action.

71. But it may be advanced, that morbid matters are known to remain in a dormant condition in the frame for weeks, months, or years, and even whole lives.

It is well known that the effects of the bite of a rabid animal which causes hydrophobia, sometimes remains in the system twelve to eighteen months before the disease actively manifests itself; and the poisons lead and arsenic, the alkalies, iodine, etc., by *continued* use, may, as shown by Dr. Pereira, "engender certain signs in the constitution, which, if afterwards persevered in, gradually develope themselves until death ensues."

The effects of mercury taken into the constitution continue to manifest themselves for years, although occasionally disappearing in the intervals. In fact, the individual who has been so unfortunate as to become the subject of a full course of mercury, according to any medical opinion, is unable, on this side of the grave, to get the information, either as to the time when he shall be rid of its effects, or the medicinal remedy which shall be able to remove it from his constitution.

72. Where, then, do these substances lurk whilst their effects are dormant, and while their presence is not appreciable by the sensitive, nervous system? From the great tendency there is for irritants which lodge in the stomach, to enrol themselves in a thick coating of mucous, which is found to protect the coats of the stomach from injury, so long as they are thus encased; there is considerable reason to believe that all poisonous substances, after they have passed through the circulatory system,

and are deposited in the more solid parts of the frame, are also there equally surrounded by a thick coating, either of exuded lymph, or other probably organized material, which prevents their direct contact with the nervous system; and, so long as they remain thus embedded, their injurious action upon the system at large may be utterly prevented for the time being.

In other instances, as in the exanthemata, the virus may probably remain in a dilute condition among the mass of fluids for some time, inappreciable by the nervous system, until, by the law of chemical assimilation, it has transformed the whole sanguineous fluid, more or less, into its own virulent condition, when the effects will rapidly become developed. Or, as in the case of syphilis and scrofula, the diseased elements may be deposited in the great nervous centres themselves, in the shape of cells or tubercles, or other disorganized and morbid structure, in which situation they are repeatedly found after death, when no symptom, during life, had induced any suspicion of their existence.' (See *Cyclopædia of Medicine*, vol. iii., p. 712.)

It is not improbable that it is the existence of morbid cells in these situations, which produces that gradual emaciation and unaccountable loss of strength, tone, and unhealthiness, observed in previously healthy constitutions, where a suspected syphilitic taint is the hidden cause; the morbid deposits within the nervous structure inducing the debility, dyspepsia, and generally depraved functions of the frame.

73. There are *many diseases that cannot be at all explained, but by the assistance of the nervous hypothesis;* while nearly *all the symptoms of disease* are obtainable alone, from the sensations, functions, and properties of nerve life.

We know that the theory of the dependence of disease upon nerve influence is, by no means, altogether new. The 'πνευμα' of the Pneumatics; the 'archeus' of Van Helmont; the 'anima' of Stahl; the theory of 'irritability and sensibility' by Haller; and the 'vis Medicatrix Naturæ' of Cullen—all, more or less, evince that the minds of pathologists have been gradually expanding to receive this simple light of truth.

In a work by Eusebius Valli, M.D., published in this country in 1793, the author observes that 'this doctrine is not novel.' 'Physicians (says he) have, for a very long time back, observed that the nervous system is first attacked in diseases.' 'Morton,' he remarks, 'particularly entertained this opinion; and no one has given so many facts in support of it as he has done.'

Morton appears to have attributed the origin of disease to the nerves, the passions of the mind, and the derangement of the animal spirits—to the latter of which, he seems most determinedly to adhere.

[*Note.*—In this essay, at all times when the nervous system is mentioned, not only the conducting filaments themselves, but also the nerve force, or vital energy which is conveyed by them, is to be understood.]

INFLUENCE OF THE NERVOUS SYSTEM MANIFESTED BY METASTASIS OF FUNCTION AND DISEASE.

74. The metastasis of secretion and excretion from one organ to another, evince the share which the nerves take in the vicarious nature of healthy secretion, as well as in the phenomena of diseased action, where there is no medium of communication but nervous filament.

Thus the secretion of the skin may be, to some extent, replaced by that of the kidney. The suppression of the catamenia is sometimes followed by a periodical discharge of blood from the lungs.

Like tissues are said to sympathise one with another. Thus inflammation of one serous membrane is sometimes followed by that of another, as peritonitis and pleuritis; gouty or rheumatic inflammation of the fibrous tissue of a joint, by like inflammation of the same tissue of the heart—the pericardium—erysipelatous inflammation of the skin is frequently replaced by inflammation of the membranes of the brain.

75. The sympathy between the skin and mucous membranes is familiar to

every observer. The sympathies with entire organs, also, of like structure and function, the salivary glands inter se—the inflammation of one eye communicated to the other, and of one lobe of the brain to the opposite—the stomach with the intestines—the liver with the tonsillary glands. Notice also the sympathies of organs, of dissimilar texture, one with another, as the various viscera of the body with the brain; and the latter, the uterus, testes, kidneys, liver, etc. with the stomach, so generally manifested by sickness on any serious lesion of these organs; the sympathy of the uterus, bladder, and generative organs, with the lower intestines, and these with the movements of the lower extremities, during exercise, etc.

Observe also the affections of the brain, which are induced by gastric or intestinal irritation, numerous cases of which may be noticed in general practice; the skin diseases which arise from the same cause, and the sympathies between specific organs, as the parotid glands with the testes, the mamma (or breast) with the uterus, etc.

In all these cases it must be borne in mind, that *it is by nervous influence alone that these effects are produced*, as there is no other intermediate channel of communication.

NERVE INFLUENCE IN DISEASE.

76. 'Contagious effluvia (says Morton) could not instantly produce any alteration in the blood without the intervention of the nerves. The metastasis, or translation of a disease from one part to another, which is not only observable in the crisis of fever, but in perineumony, in rheumatism, and, especially, in nervous diseases, in which the disease changes every hour, and sometimes even quicker than sight, and passes from one limb to another. It is not possible (says he) for any morbific matter to be separated from the blood with so great rapidity, and afterwards to be determined to some other particular part.'

In many other diseases, the rapidity with which dissolution takes place, discovers their nervous origin, but none more manifestly than the following:—Professor Robinson, of Edinburgh, relates the case of a negro who happened to scratch his hand with a piece of broken plate, and died of tetanus (lock jaw) in a quarter of an hour! Who could doubt that death was thus rapidly induced through the medium of the nervous system?

77. It has been shown, by various physiologists, that the nervous system (as already stated) is capable of being acted upon by other stimuli than the vital force—as light, heat, electricity, and mechanical and chemical irritants, etc.; and these have been observed to cause the individual nerves, to which they are applied, to manifest the characteristic properties with which they are endowed. Thus irritation of nerves of ordinary sensation causes pain; of nerves of motion, muscular contraction; of the retina, the sensation of light; and of the auditory nerves, the sensation of sound. Galvanism excites the sensation of taste in the tongue, of smell in the nostrils, light in the eye, and a musical sound in the ear.

78. It has been also shown, by experiment, that all stimuli applied to the nerves *in the dead body*, act in the same way as in the living, and produce effects differing only in degree. The excitability of a nerve which, after death, is exhausted by the continued application of a stimulus, is exhausted, also, in the living body by the same means; and, in both cases, *rest* is required for its restoration. The effects of this exhaustion are repaired by sleep, and, in some parts of the body, simply by repose, or change of action, which is but a form of repose.—(See Matteuci's *Lectures*, pp. 321, 322.)

NERVE IRRITATION.

79. It has been shown, by Professor Matteuci, that the effects of current upon the nerves differ with the direction of the discharge. That if an *inverse* voltaic current was passed, for a given period, through the crural nerves of the frog, either living or dead, the *excitability was actually augmented*, while, by the *direct* current, it was rapidly weakened and destroyed. (p. 258.) After three or four hours traversing with the former current, it frequently happened

that, at the interruption of the circuit, the limb suffered a violent contraction, which lasted some seconds, and might, therefore, be termed tetanic; and yet, when the direct current traversed the lumbar nerve of a frog, for *twenty or thirty minutes there were no further contractions*, either when closing or interrupting the circuit.

[*Note.*—It will be seen, by these statements, *how absurd is the use of the electro-magnetic apparatus in disease*, which developes currents vibrating equally in both directions.]

Again, when we operate (says he) on a very excitable nerve, and one which has never before been submitted to the passage of the (inverse) current, it is impossible to discover any *difference* between the contraction, excited by the opening of the circuit after the transmission has continued *one second*, and that which occurs after the passage has been continued for ten or twenty seconds. And when the nerve has lost a *portion* of its excitability, we then readily perceive that the *contraction* manifested, increases proportionally to the time of the passage of the current; while, with the *direct current*, the excitability is rapidly weakened and destroyed. He further remarks, that the greatest effects of the passage of the inverse current were obtained at the end of fifteen or twenty seconds; but that afterwards, *in a dead animal, these effects do not continue to increase, but are in a few hours entirely destroyed.*

He also showed, 'that *repose* restores a portion of the excitability lost by the action of the direct current, or removes the increased excitability of the inverse current;' but it is herein seen that nerve function is soon destroyed when the circulation of blood is discontinued.

80. In the human being, augmented excitability of nerve is produced by the application of powerful or long continued stimuli, as well as by electrical excitation.

Thus, after the long continued application of the stimulus of a powerful light to the eye, the *sensibility* of the retina is so increased, that even a feeble light produces intense pain, and pin-point contraction (almost complete closure) of the iris.

The stimulus of extreme cold or heat to the skin gives rise to acute suffering and excessive sensibility, and produces the inflammation of burns, scalds, frost bites, etc., as well as sometimes even gangrene and mortification.

There are other stimuli, or noxious agents, also capable of producing the state of irritation in the nerves of animals, besides intense heat or cold. Such are damp, severe and violent exercise, chemical irritants, the absorption of morbid matter, and other poisonous materials, as ardent spirits, nux vomica, etc.

81. This condition is of the most intense interest in a pathological and physiological point of view.

It is a condition which is already admitted, by the faculty, to obtain in certain diseases of a neuralgic character, as the irritable uterus, and mamma, etc. and in many other diseases; and forms, according to the ordinary views of medical men, an intermediate step between a healthy condition of parts and absolute inflammation of structure.

DECREASED IRRITABILITY AND EXHAUSTION.

82. This condition of nerve is a certain result of the state of excitability above described: over excitability is, in all cases, followed by loss or diminution of nerve power. Weak stimuli, or strong ones employed for a short period, exhaust the excitability of a nerve, and cause fatigue. Thus the continuous transmission of a direct current exhausts the excitability of a nerve in a dead animal.

The continuous gazing upon one object for a protracted period, the forcible extension of a limb only for a few minutes, or the standing for a short time in the same position, induces in each case extreme fatigue; all which are restored to due excitability again by repose, or the absence of the stimulus. On the other hand, the inefficient supply of oxygen gas during respiration, as well as of duly exciting and nutritious blood, invariably reduces the power, and, in the absence of other excitants, the irritability of nerve.

LOST EXCITABILITY OR PARALYSIS.

83. A very powerful stimulus instantly destroys the excitability of a nerve, although applied for a short period. Thus the instantaneous effect of a flash of lightning destroys excitability in the nerves through which it passes; and an intense light, reflected upon the retina, may produce snow blindness. It has been shown, by Matteuci, that the transmission of the direct current through the crural or spinal nerve of a frog, destroys all further excitability, or, in other words, produces complete paralysis. He has also shown that the same effect is produced by placing the leg in a solution of opium, or hydrocyanic acid.

That paralysis of the heart is obtained by the application of infusions of opium and tobacco, and of the intestines by opium and ticunas.

84. Similar local effects are produced in the human body while living, as evinced by the loss of contractile power, induced in the iris, by the local application of belladonna; by the paralysis of the hands, by the handling of lead; by the loss of sensibility in the lips and tongue, by chewing monkshood; and in the fingers, by the vapour of strong hydrocyanic acid.

Professor Muller has shown that this local effect becomes general by the introduction of poison into the frame. He divided the vessels and muscles of the thigh of a frog, afterwards poisoned the animal by nux vomica, and proved that the irritability of the sound leg was lost much sooner than of that in which the vessels had been divided.

The preservation of excitability in the divided leg, was attributed to the absence of poisoned blood (the latter not having been permitted to circulate through the divided leg), and the consequent absence of its effects upon the nerves of that limb.

It is believed, however, that dangerous and fatal effects are generally produced by the poison acting upon the important organs of the body, the brain, spinal marrow, and ganglionic centres, and, through them, upon the heart, stomach, lungs, etc.

[See the article on the Influence of Poisons, at the close of this Essay.]

85. Nerve, therefore, is found to possess its own peculiar normal and *morbid conditions, independently of the presence of the sanguineous fluid*, and not, as some writers seem to suppose, that it is rendered morbid only by its perverted deposition from the circulation by unhealthy blood.

The conditions manifestly necessary for the preservation of nerve itself, as well as the healthy and efficient action of nerve force, are,

1. The due development and normal deposition of veritable nerve structure, possessing a natural degree of excitability, or conducting power for the transmission of nerve force.
2. The efficient supply of nerve force in order to the fulfilment of its functions.
3. The necessary circulation and supply of fresh arterial and nutritious blood, both to the great nerve centres, and to every individual filament; which blood must possess an amount of healthy exciting qualities, consistent only with the due performance of nerve function; for the maintenance of the integrity of its structure; the continuance of its excitability and vitality; and probably for the renewal of its efficient conducting power, as well as for the development of nerve force. (See 20.)

86. To the attainment of true scientific knowledge in the successful treatment of disease, nothing appears more desirable than an acquaintance with the seat and locality in which they are primarily originated, or what portion of the animal economy forms the basis of disease.

From the limited knowledge which we possess of the action of the nervous system, it will be necessary to seize upon every known fact, symptom, condition, or phenomenon, by which some degree of light may be thrown upon this intensely interesting subject. If the fruit of such efforts results only in a more perfect understanding of the phenomena of nerve action, a highly important object will be gained, and most valuable contributions made to the science of pathological investigation. We have, therefore, endeavoured to avail ourselves of every assistance which modern physiology and natural science affords.

We have endeavoured to bring to bear upon the explanation of diseased action, not only the original experiments of Galvani, Wilson Philip, and Matteuci, but the novel facts which this nineteenth century has unfolded in anatomy, pathology, natural philosophy, and chemical investigation; the admitted causes of disease bearing upon this subject, as well as the effects of remedies employed in its relief and cure.

But, although the facts thus obtained are somewhat limited, they appear fully to answer the desired object, and to present conditions sufficiently extensive for the explanation of the general *phenomena* of diseased action. At all events, we will be content with hitherto attained knowledge until further light dawns upon this interesting subject.

CONDITIONS OF NERVE IN DISEASE.

87. We have, therefore, the *following positive and known conditions of nerve which have been discovered to exist both in the dead and living animal,* as specially evinced by the experiments of Matteuci, and as differing from normal or healthy excitability.

1. Increased excitability, or excitation.
2. Irritation, or morbid excitability.
3. Decreased excitability.
4. Exhaustion.
5. Complete destruction of excitability. And to these may be added, as discovered in any individual case,
6.
    1. Any of the foregoing conditions attended with vascular fullness, phethora, or oppression.
    2. Attended with vascular depletion or anœmia.
    3. Attended by generally depraved nutrition, secretion, excretion, etc.

[*Note.*—There appears to be a marked distinction between excitability and irritation. The former is often natural, is never attended with pain, or uneasiness, but is frequently pleasurable; the latter is always morbid, never pleasurable, generally attended with uncomfortable, and frequently painful, feelings.]

88. In the animal economy, there appears to exist a direct antagonistic action exerted between nerve and blood. Where these are equally adjusted in quantity and development, and accurately balanced, there appears to be a neutral point of influence which may be termed 'healthy equilibrium.'

89. But let *nerve preponderate* either in congenital development, or in the decrease of the mass of blood by hemorrhage, diarrhœa, profuse suppuration,* or any other morbid discharge undermining and diminishing this nutritious current of life, and nervous irritation very rapidly ensues, producing, in many instances, nervous fever, intense cerebral excitement, simulated inflammations of a most violent character, and, in some cases, delirium; and we have seen mania itself continuing for months, with no other apparent cause.

90. On the other hand, let the animal department be fed up; let plethora prevail; let the mass of nutritious blood be increased to a high degree, and the nervous system, after suffering from excitement for a given period, becomes the subject of mechanical pressure by this fluid. Gradually as this condition increases, the augmented excitability gives way to oppression of the brain, producing indistinctness of ideas, perverted vision, and other senses, incapacity for thought, and bluntedness of mind and sensation.

By and bye symptoms premonitory of tendency to fatal pressure ensue, such as confusion of thought, loss of memory, continual drowsiness, and sudden dizziness, which occasions proneness to fall. The spinal marrow suffers, and inability to perform some accustomed action ensues, or probably temporary paralysis of some part of the body; and as the organ of the mind becomes more and more oppressed (if a sudden stroke do not render the disease fatal before this period), there is a degree of general nerve irritation, with implication of the ganglionic centres gradually developed, and reflected upon the already suffering brain, evinced by a painful state of irritability of temper and irascibility, nervous terror, and sense of unaccountable apprehension and insecurity, and fear of being left alone, etc.,—symptoms which loudly proclaim the perilous storm which is impending, the approach of a violent apoplectic seizure, which may prove immediately fatal, or terminate in the pitiable imbecility and childlike helplessness of paralysis.

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* 'A rapid and profuse suppuration (says Mr. Travers) so sinks the vital powers, as to induce the state of direct constitutional irritation in an extreme degree.'

91. Congenital or hereditary *excitability* probably occurs in those individuals *naturally* in whom the nervous fibre and centres are largely predominant at birth, or in whom, at least, an increased excitability of the nervous system naturally prevails. Such persons are generally of a sanguine temperament—of considerable acuteness and quickness of mental power—of great vivacity of mind, and cheerfulness of disposition. Moreover, they possess ready irascibility, flights of imagination, enthusiasm, rapid muscular movements; accomplish occasionally great feats of enterprise, and produce sometimes extraordinary achievements by a sudden dash of genius. But the moving force is impulse, and not sustaining power, and their ammunition is rapidly expended. Such individuals are frequently, especially females, liable to spasmodic affections of the voluntary muscles, spasms, twitchings, and convulsive movements; and prone to sudden laughter or tears, sobbing, and all other usual accompaniments of the hysterical character.

92. *Irritation* appears to be a still more intense and morbid form of nervous excitability. Besides the ordinary causes of disease, cold, damp, heat, mechanical lesions, etc, this form of nerve affection is also the result of mental impressions; late hours; exciting pleasures, the rack of incessant visiting; the passions and emotions of the mind; excessive study; irregular habits; rapid locomotion; the frequent necessity for haste and hurry to meet expected trains; hurry and vexation of business, etc.; the urgency of calls so specially appertaining to the medical profession; anxiety for popularity; and public addresses given by persons of an excitable or nervous temperament; protracted and intense state of expectancy; anxiety, care, losses, speculations, etc., which form a fearful source of disease in this nineteenth century.

We may also enumerate, as the third class of causes, those which operate through the digestive organs, as improper, irritating, or poisonous food; ardent spirits, and fermented liquors; strong tea and coffee; over-eating, gluttony in living; poisonous medicines, as mercury and other irritating chemicals, etc., which all tend to produce this condition of nerve.

To these a fourth class may be added, such as spiculæ of bone, tumours, tubercles, and other mechanical irritants, which may penetrate, or otherwise injure, any given portion of the nervous system.

93. A further degree of nerve irritation is witnessed in the result of extensive burns and scalds, most severe lacerations, crushes, and other lesions; the introduction of morbid matter into the constitution; the bite of rabid animals inducing hydrophobia; the occasional shock, and extensive mischief occasionally following puerpural confinement; or in the peculiar states of constitution, described by Mr. Travers as cases of 'constitutional iritation,' occurring in persons without stamina, in gin drinkers, débauchées, and artizans of a large town, and a vitiated atmosphere; in all cases, indeed, where from excessive irritation, depraved habit, or vitiated blood, healthy inflammatory action and fever cannot be maintained.

94. If the question should be asked, as it very often has been by medical gentlemen—What is irritation? I would answer: Irritation is that state of nerve which is *demonstrated* by Professor Matteuci in the dead animal, as 'an excitable nerve,' a nerve which is prone to excite preternatural muscular contraction, with ordinary excitation. Further: it is a nerve which exhibits impatience or pain when exposed to its ordinary stimulus, as shewn by the increased sensibility of the retina, after the long continued application of a strong light, and when even the

influence of a feeble light causes intense pain. It is that susceptible condition of the nerves of the skin, which is induced by a burn or scald, or that augmentation of nervous excitability observed in the excito-motor nerves, when they act most energetically, even spasmodically, under the influence of the most trifling ordinary stimuli. It is that state of nerve which exists in the so-named 'irritable breast,' the 'irritable uterus,' or the irritable brain in puerpural mania; delirium tremens, etc.

95. The only physical condition of nerve itself apparent in these derangements, is augmented arterial action in the nerve structure; but this is involved in some obscurity. The phenomena of nerve action during *irritation and excitement*, probably depends upon the *rapidity of progression of nerve force*, just as the amount of electrical fluid transmitted along a conducting wire from *ten* four-inch voltaic pairs in series, is considerably greater than the amount transmitted from *two* pairs of the same magnitude, depending not upon the extent of surface, but upon the reciprocal action of the series.

In corroboration of this, there is, I believe, in all cases of nerve irritation and excitement, an increased rapidity in the respiratory functions, the source of this force. (See 14.)

96. Irritation and pain cannot long continue in the nervous structure without producing determination of blood to the part; and hence the old axiom, 'ubi stimulus, ibi fluxus.' When an increased flow of blood to any part of the nervous system takes place, and continues to progress, there are invariably observed to occur three distinct stages of morbid action: 1st, Excitement; 2ndly, Irritation; and lastly, Oppressed action; one stage or the other obtaining just in proportion to the degree of arterial action prevailing.

Increased arterial action itself appears to augment, to some extent, the natural susceptibility and irritability of the neural structure. Although we have already seen (79, 87) that nerve irritation is a condition independent of the blood, there is little doubt that this state (including the structure of the great centres) is attributable sometimes to the circulation of impure or irritating sanguineous fluid, or to the contact of morbid or irritating secretions with the nerve fibre; all which conditions of blood and secretions originate in the state of the nervous ganglia, which supply the digestive and secernent organs.

The nature of the blood which has to supply the nervous system with nutriment for its development, integrity, and the continuance of its vitality, formed as it is under the influence, and subject to the entire control, of the nervous centres, may be such as to materially alter the integrity of its organization, and disturb its conducting powers; and either by the deposition of tubercles, etc. in the nerve structure, or by its irritating qualities, may become itself a direct source of irritation, and yet can only be looked upon, like the mind (44), as an external irritant upon nerve, the great agent of the frame.

It will thus be seen what an incalculable influence the quality of the blood possesses in cases of mania and other mental diseases.

97. It is evident that the congestion and effects thus produced in the nerves, as they are by increased action of the circulatory system, are widely different in their characters and treatment from the *congestion which arises from obstruction to the return* of the blood by the venous system; in all which cases nerve depression, and loss of excitability, invariably prevails.

98. The condition of nerve which takes place in cases of terrible injury, crushes, lightning, etc. is no doubt, in some instances, the complete destruction of the nerve structure itself, and of its capability for conduction. In other instances, it is probably the instantaneous withdrawal of the whole powers of the system towards the injury, or in other words, the direction of all the nerve force of the frame towards the seat of the lesion; and, at other times, the momentary annihilation of the powers of life altogether, which latter appears to be the commonly received opinion. Professor Matteuci proved, in several instances, that in the frog

all the powers of life were instantly destroyed by a sudden crush of an extremity, or some large portion of the frame.

99. Diminished excitability is produced by the same causes, but is generally a secondary effect of those causes—a result of augmented sensibility, and very frequently alternates with the latter. Indeed, a general law in the animal economy is, that a corresponding depression is, at all times, the result of over-excitement.

100. Nerve exhaustion is only a still lower degree of diminished excitability, or loss of nerve force; being the product of more powerful or long continued irritants, morbid influences, shock, extreme violence, excitement, etc.

In nerve exhaustion, the development of nerve force, as well as its transmission through the nervous filaments, is probably considerably diminished.

The respiratory functions are very slowly or inefficiently performed, evincing a very sparing development of vital energy (14); the pulse is greatly diminished in frequency or power, and evinces, when attended with loss of consciousness, etc. a complete failure in the vital powers.

Complete loss of nerve function is the zero of the same condition, arising from the destruction of excitability in the nervous system by the influence of the imponderable forces, sudden shock, intense lesion, the poisons, and, in some instances, the result of injury producing destruction of these organs by sanguineous and serous effusion, ramollissement or softening, and of tumour, and other morbid growths, etc. Other instances arise from vascular fulness and congestion, and are referrible to the condition described as nerve irritation, attended with that morbid condition.

101. It appears, therefore, that the condition of nerve irritation is wisely and beautifully ordained by the great Creator and Preserver of our species, for the very purpose of exciting increased action, in order to the ejectment of all noxious matter and influences which have insidiously introduced themselves into the frame, in spite of all the admirable provisions for their exclusion.

Like the detective orifices of the body for external irritants, the very basis of the frame (for I most assuredly look upon nerve structure as its basis), the great centres of the nervous system, themselves form an instinctive, conscious, and almost intelligent apparatus for the detection of noxious material existing in the various liquids and tubes, vessels, and cells, and secretory apparatuses of the body—in fact, naked and unconcealed poison in every cavity or interstice in the animal economy; and immediately on its discovery, they set to work the various forces of the muscular or vascular system, or the excretory functions, for its expulsion.

102. As a further proof of the neural basis of diseases, I have extracted and compared their various stated and admitted *causes;* and find them to be, in most instances, such as would induce affections of the nervous system, analogical with the conditions already noticed. They are chiefly as follows:—

CLASS I.—EXCITING CAUSES.

1. Cold or wet; sudden alternations of temperature; applications of cold to the heated body, or of the body much heated to ordinary temperatures; sudden chills produced by cold air, etc.; excessive heat, exposure to the sun's rays, etc.

2. Violent exercise, local and general fatigue, etc.

3. Intemperance.

4. Suppressed evacuations; obstructed functions, as tight lacing, etc.

5. Repulsed eruptions.

6. Passions of the mind, anger, fright, horror.

7. Contagion; irritants, as poisons; excessive irritation, as the shock of parturition; of morbid matter; irritation in the intestinal canal; acrid matter in the primæ viæ; mechanical and chemical irritants and injuries, etc. etc.; teething, worms, etc.; to which may be added spiculæ of bone, adventitious growths, etc.

CLASS II.—PREDISPOSING CAUSES.

1st.—*To Inflammatory Diseases*:—

1. Plethoric habit.
2. Strong muscular system.
3. Indulgence at table.
4. Good unimpaired constitution.
5. Suppressed evacuations.

2nd.—*To Nervous Diseases*:—

1. Weak and delicate habit.
2. Nervous temperament, and general and local debility.
3. Much sensibility and irritability.
4. Sanguine temperament.
5. Study, excessive grief, anxiety, the passions.
6. Poor living; preceding disease.
7. Indulgence in spirituous liquors
8. Excess in venery, etc.
9. Profuse evacuations, or their suppression.
10. Warmth of season or climate.
11. Cold and wet seasons—variable temperature.
12. Damp and low situations—marsh miasma, etc., and moist localities, etc.
13. Hereditary taint, scrofula.
14. Want of cleanliness; pure air, ventilation, etc.
15. Childhood, puberty, adolescence, manhood, old age.

103. We have thus evinced that, of the conditions and influences assigned as the principal causes of all diseases (whatever may be the hypothesis to which the authors cling who have enumerated them) the greater part are such as are commonly received as affecting primarily the nervous system, and that with very few exceptions; and no person, after exposure to some of these causes, can tell what will be the phase of disease manifested.

SIMPLE NERVE IRRITATION.

104. Irritation of the trunk, branch, or centre of any particular nerve or system of nerves may exist, isolated, as it were, from every other class of nerves, and display its characteristics either in the nervous centre itself, in the branches which communicate with such centre, or in the ultimate fibrillæ of such branches; or the effects may be manifested upon the peculiar part, function, or organ which such nerve supplies.

105. If this irritation exists idiopathically in the brain, there may be cephalalgia (headache), mania, or congestion; irritability or sleeplessness; fretfulness or excitement, or any other of the ordinary symptoms of cerebral irritation.

105. If it exist in the cerebellum, or spinal marrow, there may be spinal pain or congestion; lassitude or weariness; 'spinal irritation' (so denominated); starting in the sleep; hysteria, etc.; with the ordinary effects upon the branches, and the organs which they supply, which derive their origin from this division of the nervous system.

106. If the irritation exists in the ganglionic centres, pain may be *entirely absent*, mischief may rapidly be going forward in some organ or viscus supplied with nerves from this great centre, and yet no symptoms which indicate serious internal lesion may present themselves; but there may, on the contrary, be developed neuralgia, rheumatism, gout, inflammation, cuticular eruption, ulcer, or tumour, etc. in some distant part, far away from the original seat of disease, with occult signs manifested in the organ affected, appreciable only by medical men, highly conversant with morbid phenomena of this class (61 62.)

107. Irritation of the motor and excito-motor nerves, proceeding from the spinal marrow, will produce spasmodic action in the muscles which they supply (see Dr. Marshall Hall's interesting labours); and will be manifested in the form of colic or tetanus, cramps or convulsive movements, or twitchings, startings, epilepsy, cough or asthma, laryngeus stridulus, or pertussis, etc.

108. Irritation fixed in the branches or nerves of sensation, induces neuralgia, sciatica, tic doloreux, odontalgia, gastrodynia, or pain in the nerve fibre of any locality supplied by these nerves, and from whatsoever source arising.

Irritation in the cuticular organic nerves locks up perspiration, or produces augmented diaphoresis, or these conditions alternately: occurring in the nerves which supply the mucous membranes, *arrests their secretions, producing a dry and parched condition of these surfaces*, such as occurs in fevers, especially of the typhoid kind, or in the obstinate constipation which takes place during intestinal inflammation; or it stimulates the membranes to exudation, and pours out mucous, lymph, purulent matter, or even blood.

Irritation of the nerves which minister to the various secretory organs of the body, as of the kidneys, liver, uterus, mamma, etc. etc. in like manner, either induces an increased flow of vitiated secretion, or arrests the functions of the organ which they supply.

109. The causes of disease may be profitably arranged in four great classes or divisions, according as they may affect (1) the brain; (2) the skin and general nervous system; or (3) the nervous expanse of the digestive canal, and thus induce an idiopathic affection of any one of these departments of the frame. (4) such as affect the lungs.

1. MENTAL NERVE IRRITANTS.	2. CUTICULAR AND GENERAL NERVOUS IRRITANTS.	3. DIGESTIVE NERVOUS IRRITANTS.
Care	Wet	Irritating food, as
Anxiety	Cold	Coffee
Grief	Damp	Spices
Excessive thought	Sudden change	Cayenne
Study	Impure air	Spirits
Mental fatigue	Exposure	Wines
Shock	Steam	Tobacco
The Passions	Hot air	Irritating Medicines,
Anger	Excitants	Strichnine
Fright	Venery	Mercury
Horror, etc.	Masturbation	Iodine
Sun stroke, etc.	Suppressed evacuations	Arsenic
Foreign bodies	Heavy discharges	Lead, etc.
Lesions	Suppressed eruptions	Starvation
Teething, etc.	Obstructed functions	Over-feeding
4. *Respiratory.*	Morbid matter, &c., in the [blood	Indigestibles, etc.
Putrid and Contagious effluviæ	Violent exercise	Worms and other Irritants
Noxious gases	Fatigue	Acrid matter
Cold Air, vapour, &c	Nervous temperament	Lesions
Mechanical Irritants	Want of cleanliness	Foreign bodies, etc.
	Lesions, tubercles, foreign bodies, etc, etc.	

110. It will not be here out of place, to remark upon the extreme views held by medical men, which, in consequence of their one sidedness, obviously exclude the simple truth.

There are not wanting, even among modern physicians, those who ascribe every possible disorder to primary digestive derangement, and the *stomach* is set forth as the universal seat of chronic disease; while others are to be found who attribute to a morbid condition of the sensorium (*brain*), the almost infinite disorders of our race.

From a survey of the foregoing division of the causes of disease, it will be at once seen that both parties are found far from the truth. That the second class of causes, or cuticular and general nervous irritants, comprehends a class of agents which affect neither of these organs primarily; and that if they do become affected by them, *it is only by reflected sympathy with the suffering organic centres, which are speedily implicated in any extensive irritation.*

There are often instances occurring in which the malady cannot be traced to any impropriety, either mental or digestive—where *the skin* alone has been the seat of morbid influence—where exposure to cold or to retained wet clothes, etc., has been the only traceable forerunner of the morbid affections. As far as I have observed of the origin of disease in this large manufacturing city for the last twenty years, whilst engaged in a considerably extended medical practice, I may state that I believe the affections arising from morbid influence upon the nerves of the skin, as the proximate cause, have been two to one for any other source of disorder in those applying for relief, although some thousands have placed themselves under my care; and, as a proof of the same, the greater part have been relieved by medicines determining to the skin, and producing perspiration.

The simple solution of the question before us, relative to the origin of human disorder, will generally be given by reference to the class of irritants to which the patient has been most exposed: and, consequently, the organ primarily and chiefly acted upon, will be that in which the disease originated; and for whose rectification, if possible, the remedies must be prescribed. I well remember a case of ascites (abdominal dropsy), which was brought on by falling into the canal during high, active, perspiration; and as medicinal agents, no remedy was found of any use until tartar emetic was employed, which produced active diaphoresis, when the boy was rapidly cured.

111. An illustration of the various modes in which primary, simple nerve irritation is modified by circumstances, is seen in the various ways in which simple *odontalgia* (tooth ache) affects different individuals. This neuralgic affection generally proceeds from cold, and ordinary febrile attack; thus coupling itself with febrile irritation.

It frequently assumes the form of *neuralgia* (nerve pain) in the face, or extending over the scalp. Sometimes it identifies itself with that state of irritation (by affecting the organic nerves), denominated phlegmonous inflammation, and a true *suppurating abscess* presents itself in the shape of a *gumboil.*

Twice I have seen it coupled with the formation of *fleshy tumour*—in one instance beneath the chin, and in another on the outer side of the angle of the jaw; tumours which arose in twenty-four hours after thorough extirpation by the knife, caustic, etc., and continued for months, until *the offending teeth were extracted,* when, without any operation, they voluntarily disappeared, and that in a few hours.

112. How numberless are the affections derivable from a wet foot! An individual who has suffered from sluggish liver for some time is, in consequence of the wet foot, affected with neuralgia; another labouring under the same affection, with acute inflammatory rheumatism in the joints; a third with dysentry; a fourth with purging; a fifth with common catarrh; a sixth with inflamed tonsils; another with pleurisy; and another with fever, colic, or other spasmodic affection.

113. It was remarked by Valli, that evidently the nervous system was primarily affected in the plague which committed such horrible ravages at Brussels in 1502; for people died whilst eating and drinking, as suddenly as if they had been struck by lightning. 'During the plague at Smyrna, I have seen' (says he), 'unfortunate wretches walking in the streets without being conscious of their being diseased, whilst a certain paleness of the face, and other appearances difficult to describe, announced to the bystander the terrible fate which awaited them.'

'If' (says he) 'the miasmata which causes periodical fever, can also produce continued fever, pleurisy, peripneumony, consumption, apoplexy, hemicrania, vomiting, cholera, colic, diarrhœa, general or partial spasms, convulsions, rheumatism, etc. it is sufficiently evident that the mode of action of the miasmata upon the nerves is sufficient to give rise to a great variety of accidents, or in other words, of different diseases.'

114. Mark the varieties of character assumed by an epidemic in any locality, how each individual modifies the disease. In cholera, for instance, a fully admitted *nervous* disease, one suffers and dies from vomiting alone; another from cramps; another from unrestrainable diarrhœa; while others suffer from consecutive fever or reaction of the nervous system; others suffer with impunity from frequent cramps as they pursue their avocations; others from bilious diarrhœa (purging), while others are struck with death on the first onset of the malady, and die without scarcely any development of the ordinary symptoms of the disease.

GENERAL EXHAUSTIVE IRRITATION.

115. I have had many individuals under my care, whose whole nervous system has been in a state of general exhaustive nervous irritation. The brain was affected, and triflingly prolonged reading or study excited indescribable head symptoms; vision became more or less impaired, and almost temporarily destroyed in some instances by prolonged attention to any one objest. The other faculties were also as readily fatigued.

The great ganglionic nervous centres were affected, and none but the most easily digestible food could be partaken of with impunity. A very trifling error in quantity or quality brought on severe spasms, or other painful symptoms, either at the seat of irritation or elsewhere. Food of a very triflingly irritating nature, as even well boiled *oatmeal*, or *bran bread* in the smallest quantity, in some instances, in others a few *foreign currants*, or the *mildest fruit* or, preserve induced severe tenesmus, and the excretion of transparent jelly-like *white or yellow mucus* from the bowels; or, on other occasions, the bladder sympathized, and there was a constant and frequently painful desire for micturition, attended with white mucus also, from the urinary canal.

A similar kind of mucus was at times, or after the application of cold, etc., developed from the larynx and nostrils. The spinal marrow was affected in some of these cases, and a very sparing amount of exercise, in others more, induced unbearable aching in the spinal column. Neuralgia was a constant concomitant after exposure to cold, and the sensibility to atmospheric changes was extreme.

116. In one such case, there was permanent contraction of the extremities, which daily increased, attended with acute pain of a rheumatic, or rather neuralgic, character. The legs and arms became permanently fixed at right angles, and she became a helpless cripple, and in this conditiôn lay immovable in bed for two whole years. This case will be commented upon hereafter.

Dr. Little, who has written on the operations for club-foot, brings forward several cases of congenital, as well as more recent cases of permanent spasmodic contraction of the extremities, which he also attributes "*to lesion of the central organs of the nervous system.*"

117. It is interesting to watch the various phases which nerve irritation assumes in the lapse of years in any one individual. A lady who has been under my care, suffered severely from an occult affection of the organic centres for several years.

For some time she was primarily the subject of *hysteria*, with all its chamelion changes. By and by her *throat* became severely affected. The *mucous membrane* was extensively inflamed; the *tonsils enlarged*, and of a leaden purple hue, inclining to black; the *liver* severely obstructed; the *mucous membrane of the intestines*, or rather their nervous tissue (for there were no signs of gastro enterite, or ordinary mucous irritation), became so sensitive, that mild aperients produced terrific effects.

Shortly *the head* became the subject of the malady. Dizziness, flashes of fire, muscæ volitants (floating bodies), sensation as of a tight band around the head, and other marks of congestion, were the chief symptoms. These were gradually removed under a very stringent diet, exercise, and other measures. Contrary to orders, however some time afterwards, this lady partook one evening (as she herself confessed) of a tolerable quantity of green gooseberry tart. The angry ganglionic system instantly telegraphed its irritation to the brain. There was a return of the congestion of the head, and extreme vertigo (dizziness) for three days; inability to walk, except by taking hold of chairs, tables, etc. besides all the former enumerated symptoms of threatening apoplexy.

As these symptoms disappeared, new ones presented. *Rheumatic Gout* commenced with considerable redness and swelling in the ball of the right great toe, and adjoining ankle. This attack continued for some weeks, and was so severe as almost to prevent locomotion.

It is evident that all cases of this character, and many others that could be named did space permit, are referrable to *irritation of the ganglionic centres.*

118. I have, in several instances, had an opportunity of watching the effects of the application of cold in my own person, in which decided irritation of the organic nerves prevails. In January last, I had *a wet foot* all day (the left.) On the day following, pain ensued in the left hip, and down the back of the thigh, developing complete sciatica. The gums also became sore, arousing dormant mercury, which had been taken years ago.

Next day pain ensued in each calf, with severe *aching and lassitude in the lower limbs, after ordinary exercise; and fatigue with very trifling exertion.*

The *recurrent laryngeal nerves* became very stiff and sore to pressure. An affection to which I have been subject for years—closure of the glottis during sleep—was much augmented in frequency and severity. Dyspepsia came on; the pulse slower than usual, very feeble; skin excessively cold; occasional chills; dry, thickened husky larynx on speaking or swallowing, etc. Thus the irritation *gradually crept up the nerves of the extremity, and by degrees (as I have often witnessed,) implicated all the old and suffering organs*, which had for years been the subjects of augmented sensibility. At other times I have had, after similar exposure to cold and wet, odontalgia (toothache), and frequently considerable redness of the ball of the great toe,—sometimes aching in the head; and, at other times, in the whole length of the spinal column—ear-ache, swelling, pain and chronic enlargement of the tonsils, etc.; but to febrile reaction I am an utter stranger.

119. In order to show the direct sympathy between the intestinal nerves and the brain, I may cite the case of a lady of spare frame, and nervous temperament, who had suffered from irritation, chiefly in the *ganglionic centres*, for some years and periodically, under my care.

She had been forbidden all kinds of fruit, acids, and other irritants; but when apparently convalescent, had forgotten her strict injunctions. At length she applied to me, when suffering from a severe attack, which appeared to have originated in indulgence simply in the ripe fruits of the season. Fomentations to the abdomen, and other remedial measures, were adopted, as there was considerable pain, but no inflammatory action. On the day following, however, the irritation had made its way to the brain, as is very usual in these cases. She became delirious; and inflammation of the membranes of this organ ensued. The original affection was lost sight of—or, probably, disbelieved in—by a physician who was called in, and the whole treatment was directed to the head, by the application of leeches, etc. In a day or two, however, *hydrocephalus* (water in the head) *ensued;* and in a few hours she sank. In this case, irritation of the ganglionic centres of some years standing, telegraphed its influence to the brain, and *there set up true inflammatory action;* thus identifying itself with the condition of nerve which exists in hydrocephalic inflammation.

Every one acquainted with the ordinary concomitants in typhus fever, is aware how intimately cerebral inflammation, and ordinary delirium are coupled with intestinal irritation in this disease.

120. I may here recite an extraordinary case of the same nature. A youth whom I attended in Manchester, suffered from a very severe form of typhus fever, for several weeks, in which the evident seat of the disease existed, as it frequently does, in the *intestinal canal.* When sufficiently convalescent to be removed, being considerably reduced in flesh, he was sent into the country for the benefit of change of air. During his stay at a farm-house, I was summoned one day in great haste, and found him in a state of *high nervous delirium.* From what could be gathered from his nurse, he had partaken of nothing but the most simple and nutritious diet, with the exception of a small quantity daily, for a few days, of *preserved fruit!* which his relations had forwarded. The jam was forbidden; and, without any other change, he regained his reason in a few hours, and rapidly recovered. It may be noticed that, when suffering from high delirium, there was no febrile frequency of the pulse, or any sign by which inflammatory action could be indicated.

In the cases already cited, it will be seen that affections of the bowels, brain, stomach, or urinary organs, voluntary and involuntary muscles, the larynx, tonsils, spinal marrow, or large trunks of nerves; of the joints, the extremities, or even of nerves supplying the teeth, took place indiscriminately from the application of the same causes, and under like conditions of the nervous system. In some instances, we have high nervous delirium; in others, congestion of the brain; and in others, inflammation of that organ proceeding from intestinal irritation. In other instances, we have permanent spasmodic contraction of the limbs; while, in others, we have temporary spasm of the involuntary muscles from the very same intestinal irritation. At other periods we have seen the same individuals suffering, now from rheumatic gout, now from neuralgia; at other times from dyspepsia; at others, from odontalgia (toothache); at other periods from swollen and inflamed tonsils: or relaxed condition of the larynx, catarrh, nervous cough, tenesmus, or affection of the urinary organs, accompanied, as usual in these cases, by discharge of thick, white, glutinous-looking mucus from some or all the orifices of the body.

121. I have, at this time under my care, a young lady, who, twelve months' ago, sat indiscreetly upon wet grass during her period. From that time to the present, the chest has been severely affected, and phthisis is insidiously, we fear, sapping the foundation of her constitution. Here, irritation of the pulmonary plexus of nerves has been the result of application of cold to the great sciatic and posterior cutaneous nerves. In another instance, in which the lady is of entirely an opposite make and temperament, a similar exposure of the same parts to cold, has produced a severe attack of chronic-rheumatism in the joints, which has remained, without any professional assistance, for eight or nine months. I have also a case, at present under my care, in which a gentleman is suffering from an attack of a very formidable eruption on the forehead, of the tubercular kind, and that of two or three years standing; in spite of all the loads of medicine with which he has been gorged.

This eruption commenced almost immediately after an *exposure of the feet,* without shoes and stockings, to the cooling influence of a brook, through which he passed one hot summer's day, whilst in a state of perspiration. No doubt this disease has been highly aggravated by the quantities of cayenne, spices, etc. with which he has stimulated the digestive organs, since the occurrence of dyspepsia, which accompanies the complaint.

I may add, that he has been an utter stranger to perspiration from the time of the exposure, until the application of the remedial measures he is now employing.

But space would fail to enlarge upon the multiform, nay, innumerable phases of disease which appear in the notebook of every medical practitioner, arising from the exposure of some portion of the body, i. e. *of some part of the nervous system to the injurious influence of cold, damp, wet clothes,* etc. which form one vast and fruitful source of disease.

122. HEREDITARY TRANSMISSION OF NERVOUS DISEASES.

It may be, however, objected, that —in order to the manifestation of the origin of diseases primarily in the nervous system—it would be necessary that there should be clearly ascertained facts, demonstrating the *hereditary transmission of nervous affections.* Such facts, we say, are clearly demonstrated to the observant eye, day by day. There is in the experience of most medical men, constantly noticed in the offspring of any particular parents, not only the transmission of likeness or form, complexion or colour, tone of voice or peculiarity of gait and action, etc.; but peculiar proneness to any specific malady. The very form of the cerebrum is handed down frequently as a heirloom, sometimes from the paternal, at others from the maternal side, and, at others, in varieties, intermixtures, or shades intervening between the two. Sometimes we notice what is called 'an extraordinary ear for music,' transmitted from parent to child, or from even more distant relatives; sometimes special talents, genius, and peculiar gifts of the mind, as memory, calculation, observation, etc.; sometimes peculiar adaptation of the hand and eye to drawing, execution in music, engineering, and machinery, or the pursuit of philosophical investigation. And if the form, size, and peculiar developement of one portion of the nerve structure is thus transmitted hereditarily, why not the peculiar development—irritability, and morbid alterations of other portions of this structure? But such we find to be the case. The various forms of excitability, irascibility, and peculiar phases of hysteria, are often noticed; and epilepsy, as well as gout, asthma, dyspnœa, and phthisis, etc. are incident to certain branches of families, generation after generation.

123. But as a striking instance among many, of *the hereditary nature of a purely nervous affection* (as well as of affection of the liver, tonsils, etc.), I may notice, in this place, the results of the transmission of the exceeding awful, and, hitherto considered, fatal disease, *spasmodic closure of the glottis* during sleep, by which respiration is completely arrested, and of which the writer has been a fearful sufferer for about seven years; but is now, by the blessing of God upon the means employed, comparatively well.

My father fell a victim to this affection, and died apolectic from *closure of the glottis*, after struggling with the complaint about three years.

My only brother has frequently suffered from this disease, and has long been liable to it, as well as to dyspnœa during any severe attack of cold. Out of the number of three children now living, his eldest daughter has frequently been the subject of *spasmodic croup*, occurring, after exposure, and during the hours of sleep.

His next child is the subject of *sluggish liver* only, and the youngest has been waked with for whole months together, when suffering from *an affection like my own*. She suffers also from *enlarged tonsils*, which appear to have aggravated the complaint.

In my own family, in addition to the *spasmodic closure*, I suffered from a *liver affection* of many years' standing, have been the subject of enlarged tonsils, which are, I believe, indicative of hepatic disorder, as a morbid membrane of these parts is of disorder of the stomach; and one of these was excised at the commencement of my complaint. My eldest son has enlarged tonsils and sluggish liver; the second child *nocturnal spasmodic croup*, after exposure; the third severely *enlarged tonsils;* the fourth, free; the fifth has had one or two attacks of *spasmodic croup*, of severe character; the sixth attacked for months together with *croupy cough*, sometimes thickened larnyx, and once or twice *inflammatory croup*, with (I believe) the formation of false membrane; the seventh has been from birth the subject of *infantilis stridulis* (spasmodic closure in the day time, and when awake), producing lividity of countenance, and all its horrid train of symptoms, after any ordinary infantile disappointment, vexation, or trifling disturbance of the nervous system.

124. DR. CULLEN'S CLASS OF NERVOUS DISEASES.

We have already shewn, to some extent, how the condition denominated irritation will influence the nerves, and through them the various parts or organs of the body, so as to produce the manifestation of many of the maladies which are placed by Dr. Cullen in his class of nervous diseases.

In this class we notice apoplexy, as generally arising from irritation playing between the ganglionic system and the great centre of the mind, and producing determination of blood, as usual, *in the direction of the line of irritation;* developing congestion, pressure, or rupture of the vessels of the brain; palsy, as a local or general result of these pathological conditions wherever situated: and fainting, indigestion, hypochondriasis and chlorosis (green sickness), are, as stated by Dr. Cullen, manifestations of defect of vital energy—or, Nerve Force.

On the other hand, we have cramp, convulsion, St. Vitus dance, tetanus, spasm, epilepsy, palpitation, asthma, dyspnea, hooping cough, colic, cholera, diarrhœa, and diabetes, as the result of either the presence of irritating substances themselves, or produced by local or general irritation, fixed in the part of the nervous system, which ministers to the organ or organs affected, as already shewn in our remarks upon the effects of irritation seated in the various localities of the nervous system. The remaining species in this class are hysteria, hydrophobia, amentia (idiotism), melancholy, mania, and oneirodynia (night mare), all which are usually admitted as nervous affections.

CACHECTIC DISEASES.

The class cachexiæ comprises emaciations, swellings, and tumours, which are admitted to depend upon the state

NOTE.—These children are now all well.

of the nutritious functions of the ganglionic nerves for their development (46); dropsical diseases, which arise from given conditions of the circulatory system, which has also been shewn to be under the control of the organic nerves (45); and cutaneous diseases, which arise from irritation, either sympathetic or idiopathic, in the cuticular branches of these nerves, and modified in these instances by depraved habit, and 'constitutional taint.' Among these, the first that attracts our attention is scrofula.

With regard to this malady, it is not very difficult to conceive that when, by hereditary descent, every nerve is depraved in its functions—the powers of life considerably below par—when, in consequence, the heart and vascular system are deficient in their action, and the important functions of the body imperfectly performed; when there is bad assimilation of food, a deficient quantity or vitiated quality of bile; when the glands of the mesentery are affected, and do not efficiently convey the chyle (such as it is) into the constitution; when the oxygenation of the blood itself is but very imperfectly accomplished, and nerve force consequently very sparingly developed; when, through the debility of the nerves supplying the kidneys, skin, bowels, and other excretive organs, injurious elements are retained in the blood for the nourishment of the whole frame, which ought to have been ejected by these organs; and when even the nerves and great nervous centres are nourished and maintained only by such sanguineous fluid as this, it is not difficult to conceive that, independently of *any original morbid condition of the blood*, sources of irritation, such as enlarged glands, tumours, tubercles, abscesses, etc. may be developed, and diseases of brain, muscle, sinew, membrane, or even bone, frequently discovered in such like constitutions.

125. From the precocious nature of scrofulous children, the general characters of this morbid affection, and the frequency of association of mental diseases with those of a scrofulous character, we should be inclined to place this disease under the class of exhaustive nerve irritation, with depraved nutrition. (87) An eminent physician, however, of great knowledge and experience in the treatment of insanity, has stated to us his belief, that *more than one-half of those who are subject to mental derangement* are of a scrofulous constitution, having some manifest indication of its existence in their persons.

It is stated by Dr. Cumming, in the *Cyclopædia of Medicine*, vol. 3 (p. 712), that after the age of two years, until puberty, *tubercles are of frequent occurrence in the encephalon (brain) and spinal cord, and are very often enclosed in cysts. 'It is' (says he) 'singularly deserving of notice that tubercles have been repeatedly found in the nervous centres, where no symptom during life had induced any suspicions of their existence.'*

126. If we include scrofula among the list of primary nerve affections, as induced by virus or morbid tuberculous deposit, acting upon the centres of life, and disposing them to morbid and depraved action, we may, by the same rule, include also equally all others which are transmissible by hereditary descent, as cancer, syphilis, scorbutus, lepra, and melanosis, etc. But on whatever account these diseases might be arranged, either here or elsewhere, the general observations made, (45, 46, 57, 66, 67), we maintain, evince that they depend for their introduction and development upon the condition of the nervous system.

127. LOCAL DISEASES.

This class of Dr. Cullen comprehends affections which are ordinarily admitted to arise from derangement of the nerves, as diseases of the *senses*, depraved appetites and depraved motions. It also embraces increased and suppressed discharges, which originate in the ganglionic system, and tumours which are developed by specific irritation of these nervous centres. Included also in this class are the several varieties of tumours, as aneurism, dilated veins, etc., mechanical displacements, and solutions of continuity, etc. etc. all which, being purely surgical cases, and not, strictly speaking, diseases, are exceptions (as are many surgical injuries) to the law of the nervous origin of disease.

128. The remaining class of Cullen hitherto unnoticed is denominated Pyrexia, and comprehends Inflammation and Fever.

Before proceeding to enter into a Physiological discussion in reference to the nature of these Diseases, we shall commence by examining evidence concerning the construction of the vascular tissue, and the influence which the ganglionic system exercises over the heart, great vessels, and capillaries of the frame.

MUSCULARITY OF THE ARTERIES AND CAPILLARIES.

129. Notwithstanding the various opinions, and assertions of Physiologists upon the muscularity or otherwise of these vessels—the authority of the justly celebrated Dr. Carpenter upon this subject is conclusive. He states in his Manual of Physiology, (582) '*That the middle or fibrous coat of the arteries consists* in part of yellow elastic tissue, and in part *of non striated muscular fibre.* (337) That "although many Physiologists have denied that the arteries possess real muscular contractions in any degree, *yet there can be no longer any doubt on the subject, since numerous experimenters have succeeded in producing distinct contraction in their walls by the application of those stimuli, which act upon muscular fibre in general.* (585.)'

130. He also observes that 'there seems much reason for attributing *to the sympathetic system of nerves a control over this power* (of dilation and contraction) *and consequently the office of regulating the local distribution of blood* in accordance with the wants of different parts. (586)' 'That any circumstance which increases the functional energy of a part, or stimulates it to increased nutrition *will occasion an increase in the supply of blood altogether irrespective of any change in the heart's action.*' 'This principle has been long known, and has been expressed in the concise adage 'ubi stimulus, ibi fluxus.'

To demonstrate the muscular construction of the arteries and capillaries it is needless to remark, is to admit the *primary action of Nerve* in all the phenomena and functions of these vessels, for Nerve is received on all hands as the agent by which all muscular contraction is performed.

In order to demonstrate the action of the capillaries, I may relate a fact which, when a student, I brought forward in a paper on the Physiology of Inflammation, read before a Medical Society in this city, which appears to me to evince the primary effect produced upon the capillaries when subjected to the influence of a powerful stimulus. When a piece of red hot iron is applied to the skin only for a very short period, a complete contraction of the capillaries may be observed by the naked eye. The natural healthy colour of the part forsakes the skin, it becomes at the seat of injury white as marble, loses its sensibility, and vitality—and remains in this condition until removed by a natural process from the living structure. This state of parts is also frequently noticed in severe burns, in which the integuments are often rendered bloodless, and converted into sloughs at the onset of injury. The same fact of contraction of the capillaries, (without loss of vitality,) may be observed occasionally in children who have been chastised with the open hand. I have seen the evident impressions of the fingers upon the skin *of considerably paler hue than the rest of the surface*, and surrounded by a red areola, remaining for days after the infliction of the punishment, and yet without any pain, swelling, or other sign of inflammatory action.

INFLUENCE OF THE GANGLIONIC NERVES.

131 For the establishment of the influence of the ganglionic system in the phenomena of nutrition, phenomena universally admitted to take place only in the capillary vessels, the experiments of M. Magendie are sufficiently conclusive.

This eminent Physiologist discovered that when *the trunk of the fifth pair of nerves is cut through within the cranium ;* twenty-four hours after the section, the cornea, (a membrane of the eye,) becomes muddy on its surface, and a large web, or cloud is formed.' 'After forty-eight, or sixty hours, this part becomes completely opake.' Besides other alterations, 'the lens itself, and the vitreous humour of the eye begin to lose their transparency, which at the end of some days has entirely disappeared. 'Eight days after the division of the nerves, the cornea is detached, and the humours of the eye which have remained liquid escape from the opening.' 'The organ diminishes in volume—gradually wastes, and finishes in fact, by becoming a sort of tubercle filled with a matter in appearance resembling cheese.' '*The nutrition of the eye therefore* (says he) *is evidently under the nervous influence.*' Similar results were also obtained from injury to the same nerves, detailed by M. Serres, Dr. Alison, and Mr. Stanley.

132. Again, the condition and functions of the excretory tubes of the skin and mucous membranes, appear *altogether to be suspended upon* the tone and excitability of the ganglionic centres. When irritation exists in these centres in cases where *anæmia*, *(bloodlessness)* prevails, or in *emaciated* individuals, the excretive functions of the skin are generally considerably deranged, being either more or less arrested, or alternately constricted and relaxed.

This observation may be made indeed, in such cases, of all the secretive functions of the frame, but it is in the skin where their depraved nature is most readily observed. Individuals who are wasted by chronic disease, are very liable, generally, to dryness and febrile condition of the skin on the slightest exposure to cold —and yet perspire profusely after a trifling degree of exertion, evincing at once considerable susceptibility of nerve, and depression of vital energy —which condition may with propriety be denominated 'exhaustive irritation.' In such cases the capillaries of the skin are blanched as regards the sanguineous fluid, while the internal organs are generally the subjects of considerable congestion, but after exposure to cold or the development of irritation, there is a constant tendency to spontaneous perspiration, as an effort of nature to carry off this morbid condition of nerve. Witness the colliquative perspirations in cholera, &c., the night sweats of hectic fever, or of common catarrh, &c.

133. On the contrary when irritation of the organic centres is induced in a *healthy or plethoric* individual, the reverse of the former condition is constantly witnessed. In this case the excretory organs instead of being readily relaxed are most stubbornly constricted and completely closed, while the cutaneous capillaries are inundated with sanguineous fluid.

134 *The same nerve irritation which, in an emaciated individual, empties the vessels of the skin, and produces alternate relaxation and constriction of their exhalents—in a case of ordinary plethora fills to repletion the superficial vessels, while it completely closes their transpiratory functions.*

This latter appears to be the pathological condition which obtains in and indeed constitutes both veritable inflammatory action, and inflammatory Fever; but the one is local—the other universal.

We have, then, *two kinds of nerve irritation*:—the anæmic or nervous, and the plethoric or inflammatory. It will be seen, that different shades of either of these two conditions, locally or universally, form a vast source of many varieties of disease; and lie at the root of all the varieties and multiplied forms of continued Fever.

IRRITATION ATTENDED BY THE AFFLUX OF BLOOD.

135. *As before stated, there is in every instance of intense or prolonged irritation in any nerve, or set of nerves speedily set up, an afflux of blood towards the part which forms the subject* of irritation, and along the *line of nerves leading to the* ganglionic centres, i. e. 'The law,' (says Dr. A. Combe,) "in virtue of which *excitement of function, and activity of circulation* in the organ performing it, *are always coincident.*" In some parts of the body the increased circulation which always accompanies excitement of function, may be made the direct subject of experiment.—When, for instance, we use the eye too long, or in too bright a light, it is soon observed to become blood-shot, and the increased action of its vessels and nerves gives rise to a sensation of fatigue and pain requiring us to desist. If we turn away the eye the irritation gradually subsides, and the healthy state returns; but if we continue to look intently, or resume our employment before the eye has regained its natural state by repose, the irrition at last becomes permanent; and disease, followed by weakness of sight, or even blindness may ensue—as often happens to glass-blowers, smiths, and others who are obliged to work in an intense light." *Dr. A. Combe's Work, p. 263.*

IRRITATION WITH VASCULAR DEPLETION, ETC.

136. When occurring in an anæmic person, or one in whom the quantity of fibrin and coagulum of the blood is deficient—the afflux of blood is but of temporary duration—or takes place only in the blood vessels which supply the filaments or trunks of the excited or irritated nerve. When the irritation is thus confined to the nervous system, and the force of circulation which supplies the nerve structure is alone augmented,—in such case we have developed, simply, some form of *neuralgia*; or the exhition of nerve irritation in some form of *spasmodic, hysteric, tetanic* or *convulsive paroxysm.* The sustaining and reactive power necessary in order to maintain a continuous afflux of blood towards the irritated organ or part of the economy affected are, in such case wanting, unless the irritation be of a very intense character—when we may have developed the results denominated ulceration, phagedena—(eating-ulcer)—or sphacelus—(mortification)—luxuriant granulations—('proud flesh,')—or tubercle, &c.; or in cases of otherwise depraved habit, there may be developed the fearful consequences described by Mr. Travers as the signs of 'constitutional irritation,' in which intermuscular extravasation of matter,—Sanies, and vitiated fluids occur in various parts of the body, (the formation of any protecting wall of healthy lymph to preserve the more healthy parts of the frame from its noxious influence and contact being absent)—destruction of tissue—sinuses—devastation, tremendous nervous excitation, and a final termination of the sufferings by an agonising death, as the not unusual results. It is a well known fact

that the shock of lightning utterly destroys the fibrinous coagulability of the blood, how healthy soever that fluid may have been previously to the shock; and is it not also probable that, in many cases previously healthy, the shock of terrific accidents, crushes, and extensive lacerations, the absorption of morbific matter in the dissecting-room, the shock of labour and puerpural mischief, severe burns and scalds, &c., destroys equally the power of coagulability of the fibrin of the blood, and renders the individual the subject of a like depraved condition of that fluid, attended with equally calamitous results. as in the cases of previously depraved habit just described.

In all these cases good, active, healthy inflammatory action is beheld as the harbinger of good tidings. In cases of this nature the system appears to be instantaneously deprived of a large proportion of its Nerve Force, and *probably all the remaining energy is directed and transmitted* at the onset *towards the seat of injury.* Corroborative of these remarks notice the vital depression, faintings, shiverings, or extreme coldness and almost extinction of respiration and circulation, which primarily occur in all cases of 'constitutional irritation,' even in cases of minor injury as demonstrated by Mr. Travers.

IRRITATION WITH VASCULAR FULNESS.

137. On the other hand, when a considerable lesion occurs in a healthy and plethoric habit, where either a large amount of fibrin already exists in the blood, or the elements and conditions necessary for its rapid development—the slowly but certainly aroused system bestirs itself with all required energy, and in a few hours after the infliction of the injury, commences a true, veritable, healthy inflammatory action proportionate to the degree of irritation developed. We therefore maintain that we have two extremes of morbid action with all their intermediate shades of admixture—derivable from *one and the same Nerve Irritation—and occurring on the one hand as simple nervousness* from the mere twitching of a muscle—the mere aching of a nerve—or the dazzling of the eye—to the extravagant actions of mania, or the awful distortions of convulsion—*and on the other hand as manifested in congestion, inflammation, and fever*—from the mere blush of erythema to the extremes of deposition of lymph, disorganization of structure, and gangrene, or the multitudinous types and forms of continued Fever.

138. That the state of Nerve is the same in both extremes, and modified alone by the temperament, habit, and peculiarities of each individual is rendered highly probable by the following general considerations.

It is found that *these two morbid conditions of nerve may be developed by the same causes, aggravated by the same stimuli, and alleviated or removed by the same remedial agents; that they manifest many of the same signs (differing only in such manner as would a-priori be anticipated from the vascular or other condition of the sufferer) are convertible the one into the other—and are indeed frequently beheld as manifesting the former condition primarily, which is transformed into the latter, in the course of a few hours.* To shew that nervous, congestive, and inflammatory affections are all influenced by the same causes, notice, how frequently is it observed that *Nerve pain* is dispelled as by a charm—by the mere diversion of the *attention* to some other object!—Is it not proverbial that the *Hypochondriac* intensifies his *ailments* by his unwearied and incessant *contemplation* of them—and has it not often been noticed that the mere *report* of pestilential epidemic has slain many of its victims, i. e , has so directed the *attention* of timid persons to the parts usually affected by the disease, that they have (independently of all communication with affected persons) ultimately developed its symptoms and died of their effects? How frequently is it noticed that the subjects of *Nervous* affections, as epilepsy, convulsions, hydrophobia, or tic doloreux for instance, are seized by a fresh paroxysm upon the approach of any object which ordinarily *excites the nervous system.*

The same remarks may be made equally in all affections of an inflammatory nature. The same care is exercised by the medical attendant to prevent disturbances of the nervous system in inflammatory diseases as in cases of simple nervous derangement. Is it not well known that *insane* persons are apt to become almost ungovernable at the *sight* of some unexpected acquaintance—or long-loved friend? I have at this moment under my care and intensely active treatment a young lady, who is suffering from an inflammatory affection of the brain, *hydrocephalic* (water in the head or brain) *fever*—and although the *inflammation of the cerebral membranes*, is considerably subdued—yet on the bare relation of a subject which seems uppermost in her mind—the face begins again to flush—the mind to wander—the arterial action to augment, and indeed all the symptoms of *inflammatory* action and *fever* to be exasperated. Every observant practitioner may call to remembrance also, cases of this nature, and of simple *congestion* of the brain, in which *study*, *thought*, or *argument* has induced instant flushing, vertigo, and many of the most distressing premonitory symptoms of apoplectic fulness.

As an illustration of the convertibility of nerve disorder into inflammatory action, the following case may with propriety here be adduced. M. H—, of S— Hall, Derbyshire, a gentleman of spare make, and temperate habits, relates that 'a short time ago he suffered from ordinary tooth ache for several weeks.' 'The pain, at times, was almost unbearable. One day, stooping down to tie his shoe, (or some other such operation,) during a severe paroxysm (attack) of pain, *in a moment* the pain ceased, to his great consolation and joy. But on attempting to uplift himself he was astonished to discover such a violent *catch* in the loins, or hollow of the back, that it became utterly impossible to assume the erect position. This seizure, which he afterwards discovered to be an attack of lumbago, continued increasing in violence for some days, but the tooth ache did not afterwards return.'

Thus, one of the most common attacks of *Nerve pain* became, in this instance, transferred with the rapidity of lightning to the muscles of the back, and there set up *rheumatic inflammatory action*, which required a persistance in treatment of the ordinary antiphlogistic or anti-inflammatory kind, for several days, before its removal could be effected.

INFLAMMATION.

139. Writers of all ages appear to contemplate inflammation as *a morbid condition of the vascular system*, or of the *fluids* which it contains.

Dr. Carpenter states, that 'the extraordinary *tendency to the production of fibrin* in the blood (631) the most important character of inflammation, seems to be also conjoined with a *depressed vitality* of the tissues of some part of the body, which indisposes them to the performance of their regular nutritive functions.' 'The depressed condition, says he, of these involves *a languor* in the movement of the blood through it, together with a *distensible state of the capillaries*, which causes them to contain a far greater amount of that fluid, than under ordinary circumstances.' 'There appears to be in the vessels of an inflamed part a peculiar attraction for the white corpuscles of the blood, by which they are drawn together from the circulating current," &c. And lastly (634) he defines inflammation, as 'that state in which there is a tendency to *stagnated circulation*, with increased production of fibrin in the vessels of the part, &c.

140. Professor Muller describes this morbid affection in a mystified and circuitous manner. He states, that 'in inflammation the phenomena are so far similar to those of vital turgescence, or orgasm, that the blood is *attracted* in increased quantity to the part, and escapes from it with difficulty.' 'Inflammation is produced by *irritation of the capillaries*, but itself consists neither in an increased nor diminished vitality.' 'It is a peculiar state,' which 'in an important organ always exhausts the vital powers." 'A reciprocal action morbid in its nature, which is set up between the tissues and the blood in consequence of the changes produced in the parts by the *irritating* cause, and which is compounded of the original lesion of the part, of a local tendency to decomposition, and of a vital action, striving to counterbalance that tendency.'—Thus, by him, mystery is rendered two-fold mysterious—and what is primarily perplexing—doubly obscure. In these, and probably all definitions of inflammation the *capillaries and blood vessels* form the main object to which the attention is directed, and the state of the nervous system seldom or never is alluded to as participating in the phenomena of the disease.

141. In the discussion of the subject before us, it will be necessary to take into consideration the changes which are described as occurring preliminary to the full development of the disease. The celebrated physiologist, Kaltenbrunner observed that when a stimulus is applied to a living part, the first effect produced is an excitement of the *sensibility of the part*, and with some exceptions, a consequent degree of *accompanying pain.*

If the irritation is only of a temporary character, this soon subsides.—'But when the effect is prolonged, or of greater intensity, the contractibility of the vessels of the part, says he, is next roused into increased action.

The result of this increased action, as admitted on all hands is, a *quickening of the circulation*, and consequently a considerable influx of blood to the part in all the vessels, and as the vessels of the surrounding parts do not partake of this increased action, the blood of the irritated vessels is not carried off as quickly as it arrives, and inevitably soon accumulates. Thus dilatation of the small vessels, and capillaries ensues—and admission of red globules into vessels previously colourless—there is turgescence—swelling, and sometimes a slow and embarrassed circulation.

To this stage of inflammatory action the term of active congestion is applied. There is also another kind of congestion of a venous character. This differs much from active congestion, and originates not in increased action in the arteries, but in obstruction to the return of blood in the veins. This obstruction is generally the result of a morbid condition of the heart—liver—pulmonary structure—or uterus—or the result of some tumour, or other mechanical impediment to the return of the venous blood. In the former we have however arterial capillary distension, in the latter, dilatation more of a venous character, each possessing its own peculiar characteristics, and requiring remedial measures directly antagonistic the one to the other.

142. The condition which more decidedly has received the appellation of

inflammatory, as noticed by authors, is that in which a still greater amount of irritation has been applied. The state of the capillary vessels is here described by Dr. Carpenter, as '*a depressed condition.*' It is termed by Professor Muller, '*a state of exhaustion,*'—by Dr. Wilson Philip, of '*debility,*' and Kaltenbrunner remarks that 'the *power and action* of the smaller vessels *diminish* as their distension increases,' 'the healthy functions of the part are more or less impeded,' 'the blood stagnates in the vessels,' and 'the blood globules are seen to agglutinate,' &c.

To this view of the direct *debility of the capillaries in inflammation so universally maintained* we can by no means subscribe, and yet it is a question of the most intense importance both to the medical practitioner, and to the public generally.

143. Mr. Travers has stated 'that the same principle which renders a part more irritable renders it over active,' and we contend that a *high state of excitation, and a state of exhaustion are utterly incompatible, the latter is passive, the former decidedly active. That the local nerves are the primary subjects of the lesion in inflammation —and all these that participate in the lesion are the source, and centre of all the irritation and disturbance which are set up in the frame—and are themselves therefore so long as the inflammatory action continues, in a state of intense and acute irritation.* We contend that all irritation tends not to the dilatation, debility, and exhaustion of muscles, but as is every day witnessed, to their augmented power, and more decided contractibility. Every excitation of animal life teaches us this fact, and the length of time that human muscles have been maintained in a state of intense and painful spasmodic rigidity and contraction, as observed in tetanus, (the extreme period of whose duration as assigned by Hippocrates himself being no less than fourteen days,) as well as the fact that these very capillaries are often locked up in continued fever for, sometimes, whole mouths together, to the entire arrest of perspiration, (134) evince that violent contraction cannot be expected to be subdued and reduced to a state of prostration and collapse in the short space of twenty-four hours, the period when inflammation begins to assume a serious character after injury. The fact of the gradual and progressive increase of ganglionic irritation shown in a former part of this essay, (61) also gives the negative to such conclusion.

It would seem indeed extraordinary if the very structure where the whole injury was sustained, and whence all the constitutional disturbance originated, should itself sink exhausted at the very onset of the production of a rapidly increasing excitement, which continues to be maintained from this part as a centre throughout the whole system for so considerable a period. *That the seat of the lesion does sustain the inflammatory fever, which is superinduced, is seen in that all acute fever, and constitutional symptoms generally* subside, *as soon as the pain and active irritation of the local nerves is appeased.* How soon in mild cases do constitutional symptoms disappear, even on the application of a *fomentation, poultice,* or *a few leeches* to the origiual lesion, which if inflammation consisted in the distention of the vessels from local *debility* or exhaustion, would only increase the malady.

It is also a well-known fact especially to the sufferer, that the *acute pain,* one of the chief symptoms of *irritation,* as well as the *increased sensibility of the part, do not forsake the seat of injury when distention of the vessels takes place,* but continue often increasing, and that for many days, or during the entire prevalence of acute inflammatory action. We must therefore look for some other cause of distention of the capillaries in inflammation, than mere debility or exhaustion.

144. The opinion that inflammatory action depends upon *increased action* of the blood vessels was maintained before the time of Boerhave. But it was found difficult to reconcile the *swelling* of inflammation, which necessarily requires an *increased capacity* of the vessels with the notion of an *augmented vital action*, which would imply an *increase of their contraction*. This physiologist endeavoured to solve the difficulty by attributing the swelling and obstruction to a change in the texture, or 'state of lentor,' of the blood itself—and to the 'error loci' of the mathematical pathologists, in which the increased action of the arteries, forces the larger particles of the blood into vessels too small to receive them, &c., &c.

145. The cause of capillary dilatation we contend, takes its rise from the condition of the *sympathetic nerves* which supply the whole line of blood vessels from the heart itself to the seat of the injury, if this is sufficiently severe to disturb the centres of life.

The irritation fixed in the local nerves is propagated slowly and gradually along these arterial nerves, and as it progresses, it continues to affect the whole line of arteries leading to the affected part. Increased fluxus of blood is consequently projected upon the capillaries—but the existing local nervous irritation (in severe cases) still preserves their contracted condition. The impetus, and amount of projected blood is augmented by each progressive step of the irritation, but the capillaries may still remain undilatable by its influence. By and by the main organ of the circulation, the heart itself becomes subject to the morbid influence, as the great ganglionic centres participate in the disturbance. Its contractile energy is increased, and an augmented amount of blood is propelled through the whole frame, but principally by the channels of those vessels, whose nerves are implicated in the irritation. The contracted and increasedly active capillaries now, under the influence of all this amount of force brought to bear upon them, *are unable to resist the overwhelming flood of pressure. They painfully give way* under this extraordinary force, and this *forcible distention greatly augments the pain*, of their already irritable nerves. During each arterial contraction this pressure is still further augmented, and thus the *throbbing pain* is produced—a symptom so frequently attendant upon inflammatory action, and which cannot be satisfactorily accounted for, except by admitting the increased sensibility and contractile disposition of the local nerves.

According to this view of the case it is manifest, that ceteris paribus, in proportion to the severity of the injury, will be the intensity of the irritation set up in the local nerves, and the consequent degree of contractility in the capillaries, the necessary degree of constitutional irritation developed in the frame in order to produce an activity in the circulatory system which shall overcome this contracted disposition; the length of time that the capillaries themselves will oppose an antagonistic resistance to this flood of pressure—and that the acute inflammatory symptoms will continue.

Surely, all the amount of febrile irritation, and forcible arterial action set up during inflammation is not aroused to so little purpose, as simply to overcome the passive resistance of a few *exhausted capillaries*, *distended by their own inability to contract*—and requiring therefore *less* arterial force for their dilatation than when in their healthy and natural condition. Such a mistake is I believe not usually committed by Nature, but I think physiologists will bear me out in the assertion, that *her efforts to overcome resistance*, are generally found *proportionate to the resistance to be overcome.* Pressure upon an artery, immediately induces in it increased contractile violence, set up to overcome the obstruction—and in morbid impediments to the arterial circulation from the heart itself, as in cases of contracted valves, ossified deposits, &c., it is known that this organ accumulates strength and energy in order to overcome the resistance, until its size, or muscular construction is so increased, as to produce an incurable, and often ultimately fatal disease, Hypertrophy, of this organ—but the exalted energy and activity is in all cases probably only in due proportion to the obstruction presented.

146. There are, moreover, certain unmistakeable characters manifested in every case of acute inflammation, which appear to me to decide the question of its physiological condition.

(1.) The part affected on the first onset of the inflammatory action as witnessed by the Microscopist is admitted on all hands to exhibit an *increased activity of its circulatory fluids.*

(2.) The blood is commonly received as the source of strength and energy, and is described in Holy Writ, as '*the life*,' and yet a part suffering from inflammatory action is evidently, in all its stages, *supplied with an augmented quantity of sanguineous fluid*,—the vessels leading to the part are enlarged—their projectile force is greater—and although engorgement does progressively increase, yet the sum total of supply, and of actual transmission of blood through the inflamed organ must be greater than in its natural state, until it becomes so engorged as to assume the first stage of gangrene.

(3.) No one in other instances would be found to dispute that augmented sensibility is a sign of increased action. The raving of an idiot—the furious excitement of individuals suffering from a paroxysm of frenzy—are all accompanied, even in weakly nervous persons, with a remarkable development of power considerably superior to their natural strength—and evince that increased sensibility is not a condition of exhaustion and debility. But in all cases of inflammation the nervous susceptibility, during the continuance of the vitality of the part, is generally proportionate to the degree of intensity of the injury received.

(4.) This last named condition takes place evidently at the cost of the other part of the frame—for all other organs and members appear to suffer a deprivation of sensibility, power, disturbed function, and circulatory supply—and the *whole vital energy and strength of the frame appears to be concentrated in the suffering part.*

(5.) Again:—the colour of an acutely inflamed member, so evidently dissimilar from the blue circulation observable in cases of debilitated action, evidently betrays augmented action. The observant eye at all times is disposed to associate a bright scarlet or arterial redness with increased action, &c., whilst the more dark red, blue, purple, leaden or venous hue is always looked upon as an evidence of exhaustion,—embarrassed circulation or collapse, and is indeed in inflammatory affections an indication of approaching gangrene, or mortification.

(6.) This state of nerve is produced by those causes that develope excitation and augmented action in the animal frame. Stimulants and animal food in excess, develope febrile action—and when this condition is already present, invariably increase it. I well remember a butcher's boy, who indulged in animal food four times daily.—He had not been long habituated to this highly stimulating diet, when *high fever* came on, attended with *ferocious delirium*, almost overpowering the strength of five individuals who held him—nor were the symptoms at all subdued until a considerable quantity of blood had been removed by venesection. This state of excitation occurred again and again, so long as he persisted in his stimulating diet, but was always removed by letting blood.

147. Further, we believe that when that stage of the inflammation arrives in which much of the irritation and acute sensibility and pain have subsided, and yet the inflammatory redness of the part still remains, that the condition may, with propriety, be termed *Chronic*, and not acute inflammatory action. The antagonistic nature of the remedial measures employed in these two diverse states of inflammation also corroborates this view of the case. The antiphlogistic have now to give way to more Tonic remedial measures. When a still further degree of irritation and pain is removed, and what in some cases may be denominated 'exhaustive irritation' alone remains,—or in some instances, simply *debility* of the local nerves and vessels, we think the term '*pure congestion*,' may be appropriately applied.

It is evident that the primary cause of the whole phenomena of acute Inflammation is, the application of the irritating cause to the nerves of the part, and that so long as the *local effects* of this irritating action prevail, indicated by the acute pain and augmented sensibility from the onset of the disease, so long do the local nerves remain in an actively (although never so much oppressed) irritable condition, and so long also are the local capillaries distended, not by exhaustion or debility, but by the overpowering and forcible distention of the heart, and great vessels leading to the part.

148. Neither, as is usually represented, does the subsequent diminished velocity of the blood, or its stagnation in the capillary vessels appear to depend upon their, so stated, 'debility,' or exhaustion. We have already noticed that there are two ordinary conditions in the vascular system, that are well known to produce capillary congestive distention—yet these two conditions, although directly antagonistic the one to the other, neither of them depend upon exhaustion or debility of their walls for the production of their dilatation. Increased action of the heart and great vessels in any given direction invariably induces more or less congestion and distention of vessels; but although the dilated vessels are free from irritation, no one would in such case contemplate their distention as the result of *debility*. An illustration of this condition is witnessed in the act of 'blushing.' In such case, did the venous capillaries remove the superabundance of blood as rapidly as it is impelled to the part, doubtless the congestion would be trifling. But when such is not the case distention must ensue, and

with that distention there must be diminished velocity of blood, or an approach towards more or less stagnation in the capillaries, *although, at the same time they are transmitting, most certainly, more fluid than when undistended.* I have been thus minute, and perhaps tedious in detail,—because an opposite opinion so universally prevails :—*an opinion which, if practically carried out in the treatment of Inflammation, would be fraught with danger, and attended by not only injurious, but often fatal consequences.*

(149.) We notice that the Nervous Hypothesis in Inflammation is to some extent maintained by Drs. Crawford, and Tweedie, in the Cyclopedia of Practical Medicine, but not the Irritation of the Local Nerves. One modern writer, after describing the various stages of Inflammatory phenomena—in the usual manner—goes on to say, that therefore the intimate vital condition of a part in acute disease is one of debility. That the local nerves themselves are 'irritable,' but that this irritability and pain is caused by '*the pressure of the excessive blood on the surrounding nerves rendering them irritable*,' and in another part of the same volume, '*they are exquisitely irritable, but their irritability is of a diseased quality, and not sustained because they are badly nourished by the blood ; the result of which* is a more than ordinary sensitiveness to the causes which first induced the disease, or to any stimulus whatever applied to the part.' The writer in question, appears unconscious of any inherent capability in the nerve structure itself of being rendered morbidly irritable independently of the circulatory system. The following will serve as a specimen—'the brain,' (says he) is composed of matter deposited from the blood vessels, and these are regulated in the manner and quantity of their deposit by the amount and character of their irritability—therefore if the irritability be acted upon vehemently (as in giving stimulants) the action of the blood vessels is vehement also, *and deposits more than usual of the brain matter, which possesses the property of sensibility, and in this way augmented sensibility is begotten.*' (See 78, 79, 80, of this Essay) as a reply to these statements.

(150.) The morbid changes which occur after decided inflammation has set in—as the result of the intensity or protraction of the lesion,—the swelling and other symptoms continue to increase in intensity, until the vessels are at length so gorged with blood, that the motion of this fluid ceases and undergoes changes in its composition—rupture of vessels ensues—and extravasation and effusion of blood—coagulable lymph, or serous fluid takes place, with complete disorganization of structure—*at which period the term inflammation is no longer applicable.*

This term ought to be limited to the stage of action which is capable of dispersion by 'resolution,'—any subsequent period being, in reality, the state preliminary to the development of its consequences—hepatization—abscess—disorganization—gangrene, &c.

If acute inflammation must be regarded as a condition of *debility* of the capillaries, and that to such a degree as to produce the engorgement of these vessels, who for one moment holding such an opinion would attempt to remove the debility by leeches or cupping, a local remedy which on all hands is admitted to be a debilitating agent? But leeches are employed —*the distended vessels contract*,— evincing the existing power, and healthy contractibility of the local nerves—the circulation in them is quickened—the pain is mitigated—irritative fever abates—resolution ensues, and the patient recovers. The fact is the *nervous tissue* of the vessels is in a state, not of weakness—but of *intense morbid excitation*—attended by overwhelming distention and pressure from more powerful vessels. The local depletion *first removes existing local morbid irritation*—and gradually, as a safety valve, abstracts some of the gorged load by which the vessels are distended. *Local irritation being lessened*, the irritative action and fever derived from it are also mitigated. Morbid activity abates—less blood is propelled. The distended *vessels possessing still the power of contractibility when the distending pressure is removed*, speedily reduce their diameter to its normal capacity —redness, heat, pain, and swelling, the ordinary characteristics of inflammation disperse—and what is ordinarily termed 'resolution' puts an end to the disease.

(151.) There is no law in Natural Philosophy more universally established than that of the *expansion* of bodies by heat, and their contractility by the application of cold. In Physiology we find that the same law to a given extent holds good. Heat in almost every form (when not intense) produces the dilatation and debility of the blood vessels, and cold gives tone and strength, and for a given period causes their contraction. But if the dilatation of the blood vessels in inflammation depended upon local debility—the application of a relaxing tropical agent must assuredly augment the existing morbid condition. But the reverse of this is proved to be the fact. If indeed the question of treatment depended simply on the *state of the blood vessels*, no application could be made to them with any prospect of success, but such as possessed a tonic, strengthening, and contractile influence. Yet, in medical practice, where one case of true inflammation is relieved by cold, one hundred are treated, and the morbid condition dispersed by fomentations, poultices, and other relaxant and soothing applications. The fact is, the local nerves are in a state of high irritation, and the application of these remedies act primarily on the root of the affection. They soothe directly, the state of nerve which is the source of mischief, and act secondarily upon the blood vessels by their soothing influence upon the extended nervous irritability set up either in the nerves of the vessels leading to the part, or in the great ganglionic centres and constitution generally.—thus, diminish the augmented flow of blood to the part, and give an opportunity to the oppressed, and forcibly distended local capillaries to assume, by what is termed '*resolution*,' their ordinary calibre, which if it were the result of debility they would be unable to do—and we should have remaining after *every case* of acute inflammation, either chronic inflammation, or congestion, owing to the permanent distention of the capillaries from their inability to recover their normal dimensions.

In direct contradistinction to the existence of the local debility of the capillaries in inflammation, it is thus not only mitigated by topical soothing and relaxing remedies, but is frequently excited by those agents that promote excessive action, and develope temporally increased strength—as stimulants, wine, alcohol, &c. It is also induced by excess of nutritious food which has been shewn (146—6) to produce highly augmented corporeal power, and nervous excitation sufficient to induce ferocious delirium and mania—and yet this nutritious aliment is rich in those substances without which true inflammatory action cannot have any existence—and which form the chief constituents of its character.—Neither can the inflamed part be said to be badly nourished by the blood, for its projection in increased quantity towards the affected part, and the circulation of an augmented amount through the inflamed organ, constitute, also, another chief characteristic of this disease.

FEVER.

152. There is scarcely any portion of the animal economy that has not served in its turn for the foundation of an hypothesis on which to build the whole structure of febrile diseases. The Ancients possessing little knowledge of anatomy, and the secretions being evidently vitiated in the progress of fever—it was natural that a morbid condition of the fluids should in the early ages of medicine be considered as the primary cause. The humeral pathology (of morbid fluids) was accordingly received as the only explanation or theory of fever for many centuries. There was generally conceived to be the existence of noxious matter in the frame which, in the attempt at its expulsion, caused a violent commotion in the system. Paracelsus, and Van Helmont imagined, that in fevers the fluids possessed at one time an acid, and at others an alkaline quality; and conceived that an effervescence took place which gave rise to a febrile paroxysm. The idea that particular forms of fever depend on a morbid state of the fluids has been, and is maintained by pathologists even up to the present time. Dr. Stephens, in his observations on fever states, that he believes the ærial poisons, from which all pestilential diseases arise, are attracted with the atmospheric air into the circulation, mix directly with the blood in the pulmonary system, (respiratory organs,) and that this poisoned or diseased state of the whole circulating current is the cause of the subsequent morbid action in the solids.

From the knowledge that lesions are found in various organs in those who have died of fever, the attention of pathologists has in later times been directed to the state of the solids, in the hope that the origin of fever might there be discovered.

Stahl, maintained that the phenomena of fever were the result of a general commotion in the system, in its endeavour to throw off a spasm induced by *torpor of the brain* and nervous system. This hypothesis was adopted afterwards by Hoffmann—and formed the basis of the hypothesis of Cullen, in which collapse, or diminished energy in the brain—producing *universal debility* and spasm or constriction of the capillary vessels—which the subsequent reaction of the sanguiferous system however resolved, and removed the fever.

This ideal production of spasm in the system from *debility*, as Dr. Parr remarks, is an isolated statement without any support. In his definition of fever, Dr. Cullen, expressly discountenances the idea of primary local disease—his theory chiefly implying, that the various exciting causes act primarily on the brain. Passing over the "sthenic and asthenic" hypothesis of Dr. Brown, which flourished for a time upon the continent, and more especially in the north of Italy

—we find another class of solidists asserting that inflammation of the brain was the cause of fever.

Others ascribed the phenomena of this disorder to primary affection of the intestinal canal, among whom stand prominent the names of Bonetus, Bartholinus, Sydenham, and others. Ultimately the illustrious Broussais promulgated the theory that fever was the result of inflammation of the mucous membrane of these organs, which is now the prevailing doctrine maintained in France.

The celebrated Pinel took a more extended view of the nature of fever than any preceeding writer of the continental school. He distinguished symptomatic from primary or essential fevers, but these he localised, evidently, by giving the organs of the circulation as the seat of inflammatory fever, and the mucous membrane of the intestines, as the seat of bilious fever, &c., &c. His views have been partially adopted, and have most probably given origin to the doctrine entertained by a large proportion of the physicians of modern times that fever is an essential disease—and independent of primary organic lesion—although it is admitted that in many cases local inflammations become developed in its progress, and constitute the principal source of the severity or danger of the disease.

153. To build any permanent and durable hypothesis upon such various and changing views as these is evidently impossible. For although there is little doubt of the truth of the humeral pathology, in a considerable number of instances, while, in others, the hypothesis of the solidists is more tenable, yet, it is equally certain, as we have before maintained, that no febrile action can be developed, either by lesion, noxious gases, malaria, contagious matter, or other morbid condition of the solids or fluids, *until the nervous centres which preside over the entire vascular system are implicated.*

It is too generally imagined (says Dr. Tweedie) that the primary disease which induces fever is essentially local inflammation. The application of this doctrine to the early stage of fever, we hold to be not only at variance with facts, but dangerous as to the practical deductions to which it leads.' 'We know (says he) that *irritation*, far short of inflammation, *is sufficient to excite feverish indisposition*, more particularly at those periods of life at which the vascular system is easily excited by apparent trivial local or sympathetic disturbance, (for example in infancy or childhood by dentition or intestinal irritation) and that this feverishness disappears when the cause is removed.'

That the symptoms of the cold stage of fever denote a primary impression on the nervous system 'is evinced (says he) by the existing disinclination to exertion, languor, lassitude, and evident feebleness or actual prostration, restlessness, mental inquietude, chilliness, tremor and muscular agitation,' 'all which symptoms are frequently developed by conditions of the mind alone, from fear, grief, shock, &c.' These symptoms are succeeded by other decided nerve signs, viz., those of augmented sensibility and reaction, such as pain in the head, back, limbs, acute sensitiveness to external impressions, sensorial disturbance, great restlessness and irritability, and not unfrequently by delirium itself.

154. That fever is a result of the same pathological condition of nerve as in inflammation is evident, in that the same effects are here developed universally, that are manifested locally in that disorder. We have already seen that a truly febrile condition, the ordinary sympathetic fever of

inflammation, *is simply induced by the implication of the great centres of organic life*—and in ordinary continued fever, the phenomena are the same—only emanating from causes of a dissimilar nature. 'The fevers (says Mr. Abernethy) produced by local diseases, are the very identical fevers, which physicians meet with, where there is no external injury.'

The facts heretofore adduced, regarding the pathological conditions of the skin during the existence of irritation, in reference to the plethoric or anæmic conditions of the constitution, (132, 133,) are in the varieties and kinds of fever abundantly verified. In plethoric habits with existing nerve irritation, we have *congestion* and repletion of the vessels of the surface —and complete constriction of their exhalents—with consequent heat and dryness of skin, and all the symptoms of high inflammatory fever. On the other hand in cases of debility, and anæmia, (bloodlessness,) or when this high state of action has run on for a considerable period, and especially if lesion of some vital organ has taken place;—all developing, what may be termed exhaustive irritation—then we have a tendency to periodical relaxation of the exhalents—alternating with constriction; and more or less bloodlessness of the surface, frequently or periodically alternating with superfical congestion, heat, and dryness —constituting true '*nervous fever*.' As we before remarked, different shades of the two conditions, increased vital energy, with plethora, or opposite state of the constitution, will produce a vast source of the many varieties and forms of continued fever ordinarily met with.

The conditions that obtain in inflammation, moreover, relatively to the first stage of that malady, are also most manifestly witnessed in the commencement of continued fever, We said, (130) that the primary action of an irritant upon the capillaries, was the production of their contraction. Now the primary or cold stage of all fevers is a marked manifestation of this pathological condition in the capillaries of the skin and surface of the body. So remarkably is this the case, that pallor, chills, goose-flesh, shiverings, &c., &c., constitute, in almost every instance, the premonitary signs of fever.

155. Further, in fever, the same physiological effects are observed that are manifested in inflammatory action. There is constriction of the exhalents —distention of the cutaneous vessels —increased heat of surface—increased rapidity of the circulating fluids— and augmented action of the heart and arteries in ordinary inflammation; and these are the common effects observable in fever of the inflammatory kind.

156. Again, during fever, there is a constant tendency to the development of insidious inflammatory action shewing the *tendency of universal irritation to become local* and concentrated, and thus to set up inflammation in any viscus without addition to the first cause which primarily provoked the accession of fever. How usual indeed is it, for the observant practitioner to watch for the occurrence of inflammation, during the continuance of fever, or even of local pain. In fact, the very symptoms that direct him in his judgment are the *implication of the organic nervous centres* with the seat of injury or pain *manifested by increased celerity of pulse* and other signs well known to the medical profession.

Thus it is seen, that inflammatory fever itself is but a general manifestation of the amount of inflammation, and degree of prevailing excitation, and is indeed one of its ordinary signs and constant attendants, from which it cannot be disassociated, when the former exists in an intense degree.

157. We view all febrile conditions then, simply, as arising from irritation of the ganglionic nervous centres, at least, we will adopt this term until science supplies us with a better, because it is a term already extensively employed both by the practitioner and the physiologist. In the writings of Dr. Tweedie, we observe him strongly condemning the views of medical men who would attempt to discover the cause or nature of fever in the various local lesions which are observed in fatal cases. But, on the other hand, (says he) the important fact should ever be kept in view, that the *primary disorder, whatever it may be, passes readily into inflammation*, and that the lesions, which arise in the progress of fever constitute the principal source of danger, and in many instances—the more immediate cause of death.

158. A cursory sketch of the most evident primary causes of continued fever may here be enumerated which, if true, clearly evince the fallacy of all hypotheses founded upon any exclusive morbid condition of the fluids or solids. As the causes of febrile disease are universal, it is not possible to comprehend in any individual local disturbance the whole of the morbid conditions by which it is developed. To the depraved state indeed of no less comprehensive an organ than the whole structure of the *nervous system*, (which we do not hold to belong exclusively to the solid structures of the frame,) can we limit the primary operation of fever, and it must be borne in mind, also, that irritation of no part of this structure can develope febrile action, until communication is established with the great ganglionic centres which are admitted to preside over the circulatory function. There is not, however, a portion of the frame where these nerves do not exist, and form, in fact, with the capillaries, the elementary basis of its structure.

CAUSES OF FEVER.

1. Irritation of the great nervous centre—*the brain*—by excessive study, or wakefulness—intense anxiety or grief—the passions—communicated to the central ganglia. In these cases there will be great proneness to delirium, and other head affections.

2. Irritation of the *spinal marrow*—developed by excessive labour, toil, fatigue, and over exertion, and by irritation in the primæ viæ (or first passages) &c., at the same time implicating the organic ganglia—and the reflex functions of the true spinal chord ; producing a tendency to convulsions, &c.; and at late periods of the disease in question, the subsultus tendinum (twitching of tendons) picking of the bed clothes &c., &c., which occur in the last stages of continued fever.

3. Irritation, &c., in the local nerves of the various organs and viscera of the body—in the nervous expanse of the primæ viæ inducing mucous inflammation, gastric and bilious fever, gastro enterite, &c., the urinary and uterine organs and in other organs as the liver, kidneys, lungs, and developing idiopathic, symptomatic inflammatory action, or other disease, and implicating, also, the organic ganglia.

4. Morbid changes *in the blood*, induced by the inhalation or absorption of poisons, decomposing organic substances, malaria, the matter of contagion or infection, floating animalculæ (if any) &c, &c.—acting upon the ganglionic *nervous tissue, supplying the internal coats of the vascular system*—and thus inducing *direct* accelerated action in the heart and arteries—one of the most usual diagnostic signs of febrile action. (*Morgan and Addison.*)

5. Direct irritation induced in *the*

nervous system by the application of cold, damp, wet, malaria, (marsh damp) infection or contagion, morbid matter, to the *nerves of the skin* or outer surface of the body, also by sympathetic implication with other nerve structures—as is observed in the primary symptoms of all febrile disease.

6. Mechanical or chemical lesion of any part of the animal frame, morbid matter, poisons &c., exciting progressive irritation, and morbid action in the nerves leading to the great organic centres—and developing what is ordinarily termed sympathetic fever—and as there exists no portion of the animal frame in which blood vessels and organic nerves do not exist—irritants or lesion in any part of the economy must of necessity provoke more or less disturbance in the ganglionic nerves.

158. In all these instances febrile action may be, and generally is, the result of more than one morbid condition—or at least, the continued or repeated action of the disturbing cause or causes. In the generality of instances after the depraved action of some organ or organs for a given period—a still further morbid action is brought to bear upon some other part or parts of the same neural structure and febrile action is established, and modified by the specific morbid actions developed, which are in such instances denominated the *remote* and *proximate* causes.

159. There is no fact more substantially verified than that fever is not established without the previous implication of the digestive viscera. But to make this statement strictly physiological, we ought to say, that in such cases it is the entire system of organic ganglia which preside over these organs as well as over the functions of the heart, the lungs and entire circulatory, secretory and excretory organs of the frame—i. e. all the great nervous centres that contribute to the phenomena of waste and supply throughout the animal economy, which are implicated before the first stroke of febrile action can be manifested. If these great and vitally important nervous centres are implicated, it may with emphasis be announced, that fever is indeed a constitutional malady.

Implication of the brain, which is held as the cause of fever by some, would cause depravation of the reflective and moral functions and voluntary powers; of the true spinal marrow; the disorder of the reflex involuntary actions of various internal muscular organs, probably including the motion of the heart, great vessels, capillaries, and involuntary muscles, &c. But implication of the ganglionic system implies structural injury—vital change in the entire organic structures—the depravation of all chemical and vital functions—and indeed the prostration and succumbence of the entire man!—of every molecule atom or element of the human frame!

160. A great point is gained in Pathology if we only establish, that the Nerve Irritation which is discovered in so-called nervousness, in excitement and anger, is a minor degree of that condition which developes delirium, idiotism, and mania. That the same irritation—which is manifested in the form of tic—and neuralgia—in debilitated persons, produces also in the muscles of others the various forms of convulsion, tetanus, tenesmus, vommiting, or diarrhœa (purging,) &c. That the condition of nerve which is induced by an intense light upon the retina—and that which is produced by a powerful direct voltaic current in other nerves—we say to prove that all these are affected by one condition alone, viz., modified irritation, *and that this is the same condition that is discovered in the minor as well as in the most*

intense forms of inflammation and fever, as well as in puerpural diseases—delirium tremens—and in cases described by Mr. Travers as illustrations of 'constitutional irritation'—would be to march many steps forward in the progress of pathological science. But however this may advance science, we leave it with the medical profession, whether this hypothesis is not strongly supported and corroborated by the facts contained in the present essay. It is a well-known fact that similar exciting causes develope in the centres of nervous trunks and fibrils—hysteria in those prone to that disease—inflammation in the plethoric—rheumatism in those suffering from hepatic disorder—frequently neuralgia in the anæmic (emaciated) with shattered nerves—or attack what is denominated 'the weak part,' whether congenitally, or accidentally induced—as tonsillitis in those subject to inflamed tonsils—cough in the phthisical—and morbid digestive function, in the victims of dyspepsia. Observe, likewise, the coincidence of the nervous condition in the so-called 'nervous' spasmodic, and inflammatory diathesis. How the morbid excitability of the whole nervous system is augmented, and the disease aggravated (as admitted practically by medical men) by the effect of ordinary nervous excitement, as the excitation of exertion, light and sound—and this in all these varieties of disease.

Thus if brain irritation, puerpural disease, the convulsive, or hysteric diathesis, &c., prevail—and a long absent, and beloved friend appears—a paroxysm, or aggravation of the complaint will almost certainly occur—and such visit is usually forbidden by the medical attendant. The very same results are witnessed, and similar medical injunctions given, alike in all cases of inflammation of important organs. Let the wrapped knockers, the straw-covered street, the darkened rooms, the muffled bells, the whispering voices, and the refused calls from relatives and friends, declare the identity of nerve condition in these diseases. If there be inflammation of the brain, or spinal marrow, observe the *spasmodic twitchings- convulsive actions—cramps*—the rigid contraction of the limbs, &c., that attend. The symptoms by which such inflammation is ushered in, viz., by impatience of light, and acute sensibility of the auditory apparatus, &c., (which former symptom is the identical instance pointed out as a sign of simple nerve irritation producible by exposure of the eye to an intense light, or for a protracted period,) (see 79. 80.) evince the truth of these statements.

Observe, that a common cause of tetanus (lock-jaw,) is the infliction of injury or wound simply to the muscular and nervous, &c., substance of an extremity, which, in many instances, developes nothing more than ordinary inflammation, and yet, in some instances, produces that degree of rigid spasm, which is rarely, if ever prevented destroying the life of its victim.

How frequently do convulsions arise in the continued fevers or exanthemata of children? On the other hand, how soon is colic, which is originally a spasmodic disease, accompanied by inflammatory fever, and exchanged for inflammation of the same part.

161. In order to manifest the increased irritability of a nerve, or system of nerves—notice the increased expectoration of the bronchial membrane in bronchitis, especially in old chronic cases, after a meal, (of which the specific gravity of the expectorated fluid will, in all cases, acute or chronic, furnish an exact estimate of the acuteness of the disease, as well as the existing degree of irritation) notice the augmented pain and throbbing in an old ulcer, wound, abscess, or other

lesion of an extremity, also after partaking of food, stimulants, &c. The instant desire to micturate and tendency to strangury, after partaking of liquid during irritation, or inflammation of the urinary organs. The tenesmus, straining, and desire to evacuate the bowels after drinking warm fluids, or indeed any aliment, in cases of dysentery, or inflammation of the mucous lining of the intestinal canal. In all these cases, irritable nerve is the particular structure which indicates the condition of the suffering organ, and the various changes, in fact, which are taking place to its injury in any part of the frame.

It is *the nerve,* wherever situated, which is most ready to execute its functions, is most susceptible and energetic in giving notice of morbid influences by pain, suffering, spasmodic or violent action—and is most easily arrested or obstructed in its operations by ordinary influences. It is, in fact, the nerve tissue (situated in what is generally termed the '*tender* (or susceptible) *part* of the body, which is so wisely designed by the Giver of all Good to draw the attention of its possessor to almost every trifing impression made to its injury upon the frame from external agencies—"*the creaking gate*' which by so soon apprizing of coming injury, tends to preserve its possessor oftentimes beyond the common limits of existence of the most robust and healthy constitutions.

It is thus seen that even the *universal nervous irritability* which is established in the system *as the second stage of all long-protracted chronic disorder*—is most benevolently and wisely set up to draw the attention of the sufferer to the *now* injurious operation of many things comprehended in the necessities of life—in air, food, clothing, sleep, shelter and temperature, which in health were as little injurious as they were regarded.

162. A truly important practical question here arises. Does nerve irritation produce congestion, or does the congestion first originating, develope the nervous irritation? Upon the truthful answer to this question hangs the most intensely important practical doctrines of medical science. If nerve irritation is usually the result of repletion of the capillaries, then are inflammation and fever, and all their concomitant maladies, not diseases primarily of the nervous, but of the vascular system. Then does the vascular system, so much contemplated in disease, become the all-important structure of the body.—Then are the coats of the vessels, and not the nerves, the most sensitive portions of the frame to all influences, both of cold, damp, heat, moisture, vapour, stimulants, narcotics, irritants, and chemically corrosive poisons. Then is the vascular system the true medium of communication to the brain, of light, sound, odours, touch, &c., and the all-important organ of sympathy; the medium by which diseased action is communicated from one part to another; the controller of the functions, and the great agent by which the various muscular movements of the body are performed. But that such is not the case, we are not left to conjecture, but may have, (as says Dr. A. Combe,) ocular demonstration of the structure which is first affected in disease.—(See 85.)

'In the result of exposure of the eye to intense light, or too long continued exposure to ordinary light, as in the case of artisans, &c., it may be observed that *the eye becomes morbidly irritable, and sensitive to even ordinary light, long before it can be observed to be blood-shot.* But if the cause is still continued, by-and-by gradual congestion of the vessels is seen to ensue; and, ultimately, inflammation, with all its injurious and troublesome consequences is established.'

There are, however, many cases of disease where the primary nervous irritation, and pain, which precede inflammatory action set in, and yet the case does not advance to vascular change—*i. e.* to the inflammatory condition, or probably even to congestion of the vessels. Such are calculus, (small stones) in the bladder, ureters, biliary duct, colic, &c., all of which, by long continuance, often terminate in inflammatory symptoms; and yet, how frequently do we see these primary nerve symptoms allayed, and the irritation induced removed without the occurrence of inflammatory action, or even the employment of such remedies as tend to prevent its manifestation.

Moreover, the length of time which takes place during the existence of pure nerve signs alone—both in inflammation and fever, after the infliction of injury, or the application of the exciting cause—before augmented action of the vascular system is observed—also corroborates the view that, *nerve is the structure which is first affected in these diseases.* It is well known, that previous to the occurrence of inflammation, *pain*, *rigors*, *faintings*, *sickness*, *and many other veritable nerve signs* are manifested after the receipt of injury, before any apparent change is observed in the vascular system, so much so, that it is an invariable rule with the medical profession not to expect inflammatory action to set in, until many hours have elapsed after the receipt of injury. It is also a fact that the premonitory symptoms of fever are known to lurk in the system, simply in the form of nerve signs, and decided derangement of the nervous system—sometimes for weeks before the establishment of fever. It is thus evident, that nerve irritation, not only precedes vascular action in fever and inflammation, but is also the source of its existence; and therefore, in these numerous affections, *nerve disorder is the basis of disease.*

In order to evince the general practical belief of the whole profession in views like these, observe the ordinary treatment of cases in which the passage of a gall-stone is indicated, or that of an ordinary calculus, (small stone), in one of the urinary tubes—the ureters. The first symptom that attracts attention is *pain;* for which opium is generally administered. The next stage manifests the setting up of severe *spasmodic action*, in which opium is still administered—*to quiet nerve irritation*, and to relieve the *spasm and pain.* But if the attack is prolonged—*although the constitution has not as yet begun to sympathise*, (as indicated by the pulse;) *yet the existence of incipient inflammation is anticipated*—(such being a common result of protracted pain)—and leeches are ordered to avert the attack. By-and-by, inflammatory fever ensues, inflammation presents—and it is thus shown that these precautionary fears were not groundless.

163. There is one valuable thing which I behold in the tendency of modern medical science:—It is the direction of the minds of practitioners, to every individual feature of nerve sensation and pain—or nerve sign—both in disease, and in the operation of all remedies employed for its cure. There is little doubt, but generations to come will behold *an intrinsic value in every individual nerve sign*, hitherto unsuspected, as well as unappreciated by the medical authorities of the present age. God has given to man, nerve signs, which all belong to the nature of instinct—as his great safeguards from danger;—preventatives of disease, and the great instigators of special curative processes during their existence.

164. If, then, nerve irritation induces neuralgia, or pain; and pain

leads to spasmodic action, spasmodic action leads by augmentation or continuance to inflammation, and inflammation provokes inflammatory fever, and a further increase of nerve irritation goes on to gangrene; *and all these morbid conditions are attended by the same pain, and other nerve signs, only differing in degree, and have originally sprung from one and the same cause,* without any subsequent addition to that cause—to what other pathological condition can we refer any one of these maladies, (I would ask,) but to the simple condition of nerve irritation? It may be noticed here, that phrenitis or meningitis—(inflammation of the brain)—*is generally ushered in by the ordinary signs of nerve irritation—as sensibility to light*—identical with the condition before-mentioned (80)—the result of protracted gazing at a strong light, and which condition is not generally followed by inflammatory action; yet we have frequent examples in practice where even this condition, by the prolonged continuance of the cause, does lead to a decided inflammatory state.

165. Let us now take a short survey of the practical bearing of the views herein contained. Take a case of ordinary inflammation. Here modern practitioners invariably attribute the inflammatory symptoms to the state of the capillaries and blood vessels. The question is one simply of cause and effect. The state of the blood vessels is looked upon as the cause—the state of the nerves seldom, or never, taken into account. Physiologists say, the calibre of the blood vessels is dilated or contracted by the agency of the nerves upon these vessels. Irritative fever comes on. The modern practitioner views this pathological condition as arising from some mysterious process termed *sympathy* extending to the *heart*, or by continuity through the tissues and *arteries* of the frame. *The* true physiologist contemplates it as irritation, arising from the injured nerves of the part, *telegraphed to the great nervous centres*; (see Sir A. Cooper's Lectures;) and from thence affecting all the viscera by them supplied—the heart, stomach, liver, intestines, respiratory organs, &c. When doctors thus differ who is to decide? To say the least of it, we complain that the teaching of the schools and medical authors, by placing before the reader, the *effect, instead of the cause*; the state of the blood vessel, instead of the nerve; confused, vague, and erroneous notions of disease are imbibed, and fostered with the very rudiments of professional knowledge; and 'sympathy' is often looked upon as the transmission of disease by vascular action, or by anatomical tissue and membrane, instead of the only legitimate and feasible channel by which it can be telegraphed—the nervous system.

166. Take a case of chronic rheumatism. In this instance, the highest authorities teach us that the source of the complaint must not be looked for in the limbs—but in some one or more of the *digestive organs*, as for instance, the liver, &c. But how few eminent medical authors for a moment take a glance *at the possibility of the great ganglionic centres* having become deranged; and yet there is much reason to believe that, in most instances, these are the organs primarily at fault. How can cold, wet, damp, &c., affect the digestive organs directly, so as to develope or maintain a chronic morbid action in them, *except through these organic centres? And yet we have instances of daily occurrence, in which the digestive functions alone are affected after exposure to cold.*

167. It may be asked, what is there new in these views; or to what practical utility do they tend? I reply, these views lead to a new, useful, and

practical diagnosis and treatment of disease. I well remember being summoned to a case of fistula, (open diseased canal issuing from the lower bowel,) which had been under several medical gentlemen utterly unacquainted with the nature of the disease they were treating. The first had punctured the supposed abscess, and healed it. It made its appearance elsewhere; it was again opened, and healed up. A third had been employed, as it again presented, and had been unable to heal the puncture which he had made. It was from this last puncture that the exploration was commenced. There were discovered to be just as described, three distinct fissures or canals, each at right angles, or in a zigzag direction to the other; and it was not until I arrived at the first and original canal, that I could resort to that ordinary operation which forthwith effected a complete cure. Just so in fever, we find an affected brain; we trace this to the ganglionic centres, and from thence to a mucous inflammatory affection of the bowels, or gastro enterite, affecting the heart and arterial circulation. We discover the first causo, not to have been situate in the skin, &c., but in the intestinal mucous membrane—say from original or hereditary susceptibility in that part, assisted by considerable irregularities in diet, and improper food. We direct our best energies to this locality—delirium vanishes and fever is gradually allayed, ultimately subdued, and the patient cured.

We discover, in another case, of an apparently similar character, that the delirium has been developed by an over-fagged brain; the constant wear and tear of incessant anxiety and loss of rest, also implicating the organic centres. The attention is now more immediately directed to the brain itself—at the same time, not overlooking the condition of the implicated ganglia, which is indicated by the existing vascular action, and disturbance in the digestive organs. In a third instance, we find an equal amount of fever and delirium, arising from an obstructed skin as its first cause—produced by exposure to cold, wet, &c. The skin obstruction is removed, and the delirium and fever rapidly subsides.

168. Mr. Travers, John Hunter, and Abernethy, wrote upon surgical diseases and injuries. The former, after noticing minor cases of nervousness, generally regarded as hypochondriacal, says, 'What share of the real and serious maladies'—'depend on a deeper rooted and more permanent cause of irritation, &c., it is not my present purpose to inquire; but whether *that disturbed state of the nervous system*, which is included in the definition of *constitutional irritation*, '*is in a very large proportion of human diseases the principle agent of destruction*.' Nevertheless that constitutional sympathy which is present in ordinary circumstances of injury or disease,—'ought to be considered not merely as subservient, but essential to the purpose of restoration.' (p. 242). John Hunter, describing the constitutional symptoms of local lesions—divides them into three: the immediate, or sympathetic fever; the indefinite, or nervous affections; and the remote, or hectic symptoms,' and says '*These affections seem all to have more connexion with the nervous than the vascular system*.' He goes on to shew that an individual may have a bad compound fracture of the leg. The first symptoms may be violent, but he appears to have got the better of them. Suddenly he is attacked with (a decidedly nerve sign) a shivering fit—re-action shall not perfectly come on—and he shall have certain loss of appetite, quick pulse, &c., and die in a few days; or he shall be seized with the nervous signs—with many of their effects, as tetanus, (lock-jaw,)

and dissolution shall ensue. Or if not, the local disease may not heal—the lesion affects the constitution, and he dies of hectic fever.

169. 'Mr. Abernethy,' (continues Mr. Travers,) 'eminent alike for the sagacity, soundness and clearness of his views, as a pathologist, to whom the profession and the public are indebted for the improvement—I might almost say, for the introduction of medical surgery, distinguishes the fever which attends upon injuries into the *sympathetic* inflammatory, the hectic, and the *sympathetic* typhoid, or *irritative fever.*' Moreover, he goes on to say, that '*The fevers produced by local disease, are the very identical fevers which physicians meet with where there is no external injury.*' *Local disease, injury, or irritation, may induce, as its immediate consequence,—pain, sickness, fainting, rigor, convulsions, delirium, and tetanus, (lock-jaw.)* And '*These nervous affections have the natural priority.*' 'It may be, indeed, (Mr. Abernethy states) *a fit subject for inquiry, whether it be possible for particular organs to become affected, otherwise than through the medium of the nervous system in general!!!*' Though some instances of sympathy are strange, and perhaps inexplicable, there are strong reasons for believing that the *inflammatory fever*, the state *of vigilance, delirium, convulsions, and tetanus,* which arise in consequence of injuries of the limbs, are produced by *irritation imparted to the brain,*' &c. He also regards the irritative fever as a necessary consequence of the local disease or injury.

170. Sir Astley Cooper observes—'Injuries producing fatal consequences destroy life in three different modes—1. When slight, *by keeping up a continued constitutional irritation*, they gradually wear out the system. 2. When more severe, they destroy by occasioning *excess of action.* 3. The most severe, *by shock to the nervous system*, cause death without re-action.' The *rationale, and the treatment of irritation*, as given by Sir Astley Cooper, (says Mr. Travers,) are *precisely the same as of inflammation*—both being considered as decidedly co-operating in the restorative process. 'When a part of the body receives an injury, *the nerves* convey a knowledge of it to the important organs—the spinal marrow, the brain, heart, stomach, &c.; nature immediately commences the restorative process by stopping all the customary secretions; the various outlets being thus closed, the blood collects in quantities in the heart and large vessels, which propel it with unusual force to the injured part; giving rise to inflammation in whatever form can best accomplish the desired effect.' 'This is an illustration of the manner in which nature contends for a cure, &c.'

'There are,' he remarks, 'two means of reducing irritation:—first, by restoring the secretions of the different organs; and by thus opening the outlets, to lessen fever.' '*The second mode of relieving irritation is by allaying the excitement of the nervous system.*'—'I do not include among the nervous affections, which decidedly ensue upon injury or inflammation, the traumatic tetanus, (rigid spasm), because I consider it to be, not only a secondary, but proper constitutional action, although grafted upon the local injury; which I therefore designate by the term, *reflected irritation.*'—(Sir Astley Cooper's Lectures—Lecture 1.)

Mr. Travers states '*Inflammations like fevers, remit and intermit, which is the characteristic symbol of nervous affections; and the existence of these variations of action—and I may add, their modes of cure, are proofs that they are directly contingent upon corresponding alternations of nervous action, or fluctuations of nervous supply.*'

(page 256 of his valuable work.) Again, '*In so far as fever is sympathetic, it is the sign of constitutional irritation most intelligible;* and upon the whole, most tractable, &c. But in proportion as the nervous system is distinctly and deeply affected, the sign of fever is less perceptible, or more frequently altogether wanting; and the treatment of inflammation requires to be essentially modified.'—(page 255.)

In his remarks upon the treatment of genuine inflammatory fever, he says, 'If the inflammatory action be marked and vigorous, the nervous action, (irritation, I presume,) which supports it is strong and inirritable; and the former, cannot be suddenly pulled down, without a serious encroachment upon the strength and steadiness of the latter.' I say, the less violent our measures of interference the better. Nervous power is much more easily depressed than raised. Irritation is a very possible result of treatment as well as of malady for *by such means as too rapidly lower, we incur the danger of converting inflammation into irritation;* and thus of destroying our only medium of recovery—(see (136—137.)

It is evident from these statements that Mr. Travers regards inflammation and irritation as two distinct things,—and, indeed, he declares this pointedly at page 249. 'Inflammation is strong and effective, or the contrary as it is free from irritation or mixed with it. The irritation, symptomatic of inflammation, has generally more or less of febrile action blended with it.' , But irritation, nevertheless, is not fever under any modification. Fever requires—and as Mr. Hunter justly observes—shows powers of resistance. *Irritation* conveys to my mind the idea of *deficient powers to constitute fever.* In irritation we have no determinate or continued train of actions. It is everything by turns, but nothing long. Teachers appear to me to confound irritation with inflammation, or fever; and, because they sometimes co-exist, to conclude they coincide. They are originally, and essentially, distinct forms of disease; and either may exist in the absence of the other.'

The secret of the whole matter appears to be—that without a due and sufficient supp'y of good nutritious blood—rich in fibrin—that nervous action cannot be maintained, which is necessary to sustain a constant afflux of blood towards the affected part; nor can that turgescence of the capillaries be induced which is necessary to constitute healthy inflammatory action—both which facts amply explain the physiological dissimilarity between these two modifications of the same condition of nerve.

Had this author only viewed irritation in two aspects—one which occurs in healthy habits—'irritation with vascular fulness' (137) where the injury is not excessive, and in which it is followed by good, healthy, restorative, inflammatory action, and the other—as irritation with vascular depletion (136)—that which occurs in cases of 'constitutional irritation'—where the whole system itself is at the onset depraved, morbid, or irritable;—or, the shock to the system very severe, &c., he would have had a solution for the phenomena. These views are clearly manifested in his writings. (See an Enquiry into Constitutional Irritation, by Benjamin Travers, F. R. S. &c.) *Although nervous irritation, and inflammatory action, and fever do arise from precisely the same exciting causes, and the same condition of nerve; yet this irritation is so modified by the existing habit,* that in the one case, the excitement set up is highly salutary, and restorative of health; while, in the other case, it may lead —for want of sustained action and through deficiency of fibrin—to high, nervous, or hectic fever, and to all the unhappy results so ably set forth by this author. The fact is, nerve action in an anæmic person, that is, where it is not duly balanced, and sustained in its legitimate functions by an appropriate supply of good nutritious (fibrinous) blood, may very correctly be compared to a wild horse let loose—to a vessel, tossed by the tempestuous influence of the ocean—without helm or ballast—or, perhaps, more appropriately to a clock whose weights are running down, unrestrained by the governing and regulating motion of the pendulum. The attacks that, under these circumstances frequently ensue, even in the extremely debilitated, are violent, intensely painful—and appear, in some instances, to threaten immediate dissolution. They simulate almost every variety of disorder, and there is no part of the frame that can be protected from their assault. Frequently, from their close resemblance to inflammatory action, there is danger of the inexperienced employing depleting measures, which can only render the malady more and more urgent; and if persisted in, must, of course, destroy the life of the sufferer. But there is no sustained action, or, as says Mr. Travers, 'We have no continued train of actions,'—there is an insufficient supply of that fluid, *without which nerve force itself cannot be developed*, and after a very smart and violent seizure—before the remedies perchance are quite prepared—the uncontrolled nervous system has removed its assault, to some other structure, or from direct exhaustion of nervous energy, has yielded the contest and retired from the field.

171. M. Broussais, who has treated more largely upon this subject than many other writers, bases his description of it upon the particular physiological views which he entertains respecting the vital properties of animal structure. These properties he calls *sensibility* and *contractibility*:—they are possessed in various degrees by the *different tissues*, and may be locally increased by certain circumstances;—such local exaltation always causing a diminution or depression of vitality in some other organ or system. "*This exaltation of vitality is accompanied by an excessive afflux, or congestion of fluids to the part;* and constitutes what M. Broussais designates *irritation.* He also maintains that irritation once formed in any part of the system, becomes a cause of irritation in other parts or systems; the influence being propagated by sympathy through the medium of the nerves, 'The *first seat of irritation is stated to be in the nervous fibrils of the irritated part; and even in this stage, the irritation may be so intense, as by means of the sympathetic effects on the system, to cause death.*' 'But M. Broussais,' (says Dr. Williams,) 'looks to the *effects on the vascular system as the most important;* and if he does not, in his pathology, describe irritation as vascular, universally, his therapeutics certainly imply this. Accordingly, *the terms irritation and inflammation are used indiscriminately throughout his works.*'

He remarks, 'In all febrile diseases and considerable inflammations, the heart is sympathetically irritated, whence the quick pulse and the hurried circulation; *but the main and most important seats of irritation, either primary or sympathetic, are the mucous membrane of the stomach and bowels, and the brain.*' '*In all fevers called idiopathic, these irritations are the primary evils;* they are equally so in the exanthematous, and other diseases; and *there is not an inflammation of any extent sufficient to quicken the pulse, which does not produce a decided irritation of these organs.—The cerebral irritation is, in most* *instances, secondary to that in the stomach and bowels.*' 'Great credit is due to M. Broussais,' (says this writer,) 'for having fully established the fact, that local inflammations, particularly in the stomach, and bowels, are present in most febrile diseases The most salutary results have been obtained from the application of this knowledge to practice, in the judicious use of adequate measures, and a more cautious prescription of purgatives and other medicines.' But there are, doubtless, many cases of fever where mucous inflammation is suspected, but where none is subsequently discovered, and these can be referred alone to irritation of the organic centres.

Adverting, again, to the doctrine of M. Broussais. Dr. Williams remarks, that 'were the former a little more impartial and considerate towards his own principles, and would take more into view *that state of the Nervous system, which he acknowledges to be primary in the state of Irritation; and which as existing alone may properly be viewed as an object of distinct and specific treatment.*' If he would admit that '*a certain state of the vascular system is required before the irritation can produce Inflammation,* and that therefore antiphlogistics are indicated when this state is present, and if he would take into consideration the secernent and exhalent power, as well as the inflammability of the vascular system, and recognize the salutary operation of certain alterative, evacuant, and astringent medicines; then his physiological system would stand on a broad and comprehensive basis, and its application to practice would be consistent both with principle, and with the general experience of the most successful practitioners.'

172. Sir B. Brodie, remarks in his treatise on diseases of the joints, published in 1840:—'I must confess, *that in proportion as I have acquired a more extended experience in my profession,* I have found more and more reason to believe that local diseases—in the strict sense of the term, are extremely rare.' 'Local causes may operate so as to render one organ more liable to disease than another; *but everything tends to prove that, in a great majority of cases, there is a morbid condition,—either of the circulating fluid, or of the nervous system—antecedent to the manifestation of disease in any particular structure.*'

173. And lastly, 'Mr. Travers's work,' (says Dr. Williams,) 'would give to the word—irritation,—nearly as extensive a sense as that in which it is accepted by M. Broussais, since inflammatory and all kinds of symptomatic fevers are included under it; and physiologically speaking, they are so with great justice,' &c., &c. 'Irritation may be considered to be the introduction, or preliminary state to inflammation.' '*It is the mobile part of it, and being transferred from one locality to another, draws the phenomena of inflammation after it.*'

NERVE PAIN.

174. A modern writer, (Dr. Whiting,) speaking of *pain* in the animal economy says, '*The sensation of pain seems to be essentially connected with the operations of the Nervous System:* It may arise, 1st—From an undue degree of pressure being made upon the nerves, or from injury sustained by external violence. 2ndly—From increased sensibility in the nerves themselves so that the pressure, or influence of external objects, which under ordinary circumstances only produces the sensation of touch, or, as in some parts, even no sensation at all, gives origin to a painful sensation. This increased sensibility may be the result of many different causes—*e. g.*, of morbid structure, or, morbid function of the brain,

of the spinal marrow, or of the nerves themselves. When this increase of sensibility occurs, pain may only be felt when external pressure is applied, and then it is denominated *tenderness;* or the pain may be felt independently of such pressure. 'It is very probable that in some painful diseases there is nothing morbid except the functions of the nerves themselves; no organic alteration,—no inflammation—being discoverable either before or after the death of the patient. Pain in such cases is called *Neuralgia.* It occurs sometimes in paroxysms leaving intervals of ease more or less complete; sometimes it is constant. Tic doloreux and the periodic face ache are instances of this species of disease of the nerves. We know very little of the real nature of sensation. Probably that peculiar property of the nervous system, which we denominate *sensibility*, or the capability of feeling, becomes *so increased, in some instances, as to produce, by itself the sensation of pain*—yet in other cases the sensibility of the nerves seems to be increased, and pain produced by certain appreciable changes in the condition of the part, which is the seat of pain; and this may be illustrated by what occurs in inflammation; pain being almost the constant accompaniment of the other symptoms. The parts of the body which are the most sensible to the touch are found to be more plentifully supplied with blood-vessels as well as nerves: and it appears that the large supply of blood sent to them is more than sufficient for the process of nutrition. It is also found that when the flow of blood to these parts is interrupted, without any injury having been done to the nerves themselves, numbness, to a certain extent, is the consequence. These facts lead us to conclude that the sensibility of a nerve bears some proportion to the quantity of blood circulating in the capillary vessels in connection with it. We should therefore expect that when, as *in the case of inflammation, a large quantity of blood is thrown into the vessels, an increase of sensibility of the nerves would be the consequence.*'

Many physiological and pathological facts might be adduced in corroboration of the opinion just stated; but enough, probably, has been said to answer the present purpose, which is to shew that the increased sensibility of a part, in inflammation, depends very much on the increased determination of blood to the part inflamed.

175. Dr. Billing, has endeavoured to show, 'that all these diseases of the nervous system which are characterized by irritation, or morbid sensibility, consist in a relaxed, enlarged, and congested condition of the capillary arteries of the nerves.' Indeed, he goes much further than this, and declares, 'that all diseases have exhausted nervous influence for their cause.—That all diseases are caused by impressions made upon the nervous centres, or their nerves by which the nervous influence is exhausted, or morbidly diminished. That the capillary blood-vessels which, in health, are always held in a state of semi-contraction by virtue of this nervous influence shed upon them by the nerves, become relaxed and weakened, and are thrown, in fact, into a state of congestion.'(See Inflammation, 141, 145, &c.)

SPASMODIC ACTION.

176. 'When the nerves are rendered morbidly sensible by inflammation, or by any other cause,' observes Dr. Whiting, 'the pain from spasm will be more severe. Many facts warrant the conclusion that in some morbid conditions of the body, *excessive sensibility of the nerves, and muscular spasm often coexist as essential parts of the same disease.*' Having thus far associated, as analogical, the condition of nerve pain which obtains in *spasm,*

neuralgia, and *inflammation*, &c.; this writer goes on to say, ' Pain may be alleviated, or subdued :—1st. By the removal of the remote cause, such as inflammation, spasm, external pressure, &c. 2ndly. By the employment of remedies, which *reduce the degree of sensibility of the nerves*;—and 3rdly. By the employment of remedies which render the brain so torpid as to prevent the patient feeling the effect of the usual causes of pain.

177. Dr. A. T. Thomson, has shewn that spasmodic action is necessarily developed by the state of the nervous system; 'In whatever manner,' he observes, 'muscular action takes place, it may be affirmed that it is altogether attributable to the nervous system, the nerves of motion being those engaged in it, whether the stimulus or exciting power be mental or material. 'The motion which is induced is transitory and always followed by a state of rest: it is this alternation of motion and quietude, under due regulation, which constitutes the distinction between ordinate and inordinate muscular action. If after muscles have contracted, they retain this condition when the exciting cause ceases to operate, they are said to be in a state of spasm,' &c.

178. This writer proceeds to notice, also, the great power which the *mind* possesses over spasmodic action. ' In every instance of spasmodic action, (he remarks,) from whatever cause, the attention is directed to the part affected. So long as this exists, no corporeal agents, which do not make a greater impression on the mind than that produced by the spasm, can resolve it. But when the attention is withdrawn from the spasm it is instantaneously relaxed. Thus, a man has his shoulder-joint luxated: and, after various attempts, the luxation cannot be reduced on account of the spasm which has supervened, and which is maintained by the attention of the patient being directed solely to the part. But, abstract the attention, and the spasm instantly yields, and the head of the bone slips into its socket. We have often seen the same effect produced by the diversion of the irritation to the stomach, by the excessively depressing action of a large dose of Tartar emetic.

179. The complaint which is denominated Spasmodic Asthma—and in describing the Pathology of which the characteristic conditions of many other disorders are equally declared, is thus described by Dr. Forbes. ' In admitting the existence of spasm of the bronchi however as essential to constitute the disease, we are very far from looking upon it in a practical point of view, as in every case the most important part of the affection. On the contrary, many of the other morbid conditions, general or local, which commonly precede or coexist with this phenomenon, are of infinitely greater importance both pathologically and in practice; but so long as these conditions are unaccompanied by this peculiar affection of the muscular fibres of the bronchi, the disease is not termed asthma. And again, ' In all these cases, if the *nervous centres are not primarily affected*, they invariably become so, subsequently; and the circumscription of the local manifestation of the spasm to the muscles first disordered thence becomes very improbable. Evincing still further the implication of the great nervous centres in this complaint, he shews that, ' other muscular affections of a spasmodic kind, are not uncommon in the paroxysm of asthma. "The sudden calls to empty the bowels are no doubt partly owing to a morbid action of the muscles concerned in this process, although chiefly, perhaps, the consequence of the same general disorder of the nervous, and vascular systems, which give rise to the pallid and shrunk

state of the surface, the flow of limpid urine, &c.

'In a young man now under our care, subject for some years to periodic asthma, which generally attacks him during sleep, the first indication he has of the invasion of the paroxysm is an involuntary spasmodic twitching of the right leg, or foot, of which he is conscious for some time before he is fully awake, and of which the increasing violence awakens him. The twitching always leaves him on becoming quite awake, but he finds himself then under the full dominion of an asthmatic paroxysm.'

180. Dr. Conolly, (late Professor of Medicine, in the London University,) appears to attribute the sources of disease, mainly, to the two great systems of the human frame,—the vascular, and the nervous. 'But,' says he, '*The whole system of nervous pathology is in great obscurity.*' In describing the various influences which develope human diseases, he thus writes:—'The element to which man is chiefly, and at all times, exposed, is the air. Its variable temperature, dryness, and moisture; its alternations of calmness, and commotion; and probably, also, its variable electrical states; not only immediately affect the *surface* and the respiratory organs, but, through the latter, the blood, and *through that fluid* the energy of all parts of the system. Some of the variations seem to have a direct influence on the *Nervous system*, and there are presumable properties in the air, yet unknown, save in their destructive effects, which are largely concerned in the production of our common continued fevers; the yellow fever, the plague, the intermittents of fenny countries, cholera, and what is called influenza. No doubt can be entertained of the agency of such atmospherical influences in the production of the common eruptive disorders; and of one, at least, of the disorders characterized by irritation of a particular portion of the nervous system, (the respiratory,) and by spasm—circumstances exemplified by the hooping-cough. *The direct influence of the air on the Nervous system is not easily proved! but to this,* or to some effect produced on the *fluids* or *solids* of the body, together, or separately, must *be ascribed the variations of feeling, and spirits*, experienced by so many individuals in variable states of the weather, and the suicidal despondency which medical travellers have found to be induced by the 'sirocco,' (Dr. J. Johnson.) The condition of certain structures of the body, and *perhaps of their nerves*, is seen in the course of the seasons to be materially affected by certain states of atmosphere: the effects being sometimes, merely the result of temperature as in the catarrhs, and disorders of the respiratory, and circulating apparatus in the cold weather of severe winters; but at other times more obscure, as in the *irritability of the mucous membrane* of the stomach and intestines in the summer and autumn, of which the consequences are periodical dyspepsia, gastric fevers, diarrhœa, dysentery, and Cholera.'

The influence of a high temperature combined with excessive moisture has been abundantly experienced in the diseases incidental to tropical climates.

Dr. Conolly, however, seems inclined, in all his writings, to maintain the doctrine of *equal susceptibility of the vascular and nervous systems!* With regard to fever he states, 'that its place must depend on the yet undecided question of its actual nature. The vascular and the nervous depression, and the subsequent *excitement of both the blood-vessels and the nerves*, are sufficiently evident. But not only is the order of these phenomena yet undetermined, but their relation to a primary impairment of the vitality of the blood, at least, not disproved.'

'General excess of nervous power' (he continues to observe) 'or general nervous excitement is not often seen distinct from excitement of the vascular system.'—'*The nervous excitement may, however,*' (he admits) '*exist first, and therefore, separately.*' (See 162.)

There is here exhibited, timidity, or at least, reservation, in the promulgation of important truths, which do not well become the mind of one of our most celebrated, modern, Metropolitan physicians.

If statements like the above must still emanate from the propounders of medical science, it will be high time to revise and correct the general teaching of Anatomists and Physiologists—that the nervous system is any longer the part of the frame which receives, feels, and transmits external impressions, or that it is indeed the legitimate and acknowledged structure in which "susceptibility,"—"irritability," or "variations of feeling" can possibly be developed—the only medium of communication between mind and matter—between external influences and the inner man.

If views, indeed, such as Dr. Conolly promulgates could only be substantiated, it is not improbable that we should be able to dispense with the nervous system altogether—as, it would no longer need to take any part in the functions of animals!

181. Observe, in contrast with, and in answer to these sentiments, the bold and decisive language of the late Dr. Combe, of Edinburgh.—'*It is evident,*' (says he) '*that the Nervous system surpasses in importance, and is meant to preside over all the other parts of the organism.*' 'It is by means of its great central organ the brain, and in proportion to its development and perfection, that the various processes of sensation—perception, thought, and volition take place; and as, in this view, the body may justly be said to be the instrument of the mind, so all its component parts are placed, more or less, directly under the influence and control of the brain, as the more immediate organ of the mental powers. *Throughout the whole Animal Kingdom, indeed, the same subordination of the organism at large to the Nervous system may be traced,* with distinctness proportioned to the intelligence of the animal, till we descend so low in the scale of being that all traces of distinct consciousness and nervous structure disappear together, and life becomes almost wholly vegetative.'

At another portion of his work, when speaking of the care and judicious arrangements made by Captain Cook, on shipboard, to preserve the health and lives of his sailors, during a voyage of three years through all climates from 52° North, to 71° South, with the loss of only one man, &c.: Also in the Hecla, and Fury, by Lord Nelson, during 27 months, in which they were entirely dependent on their own resources in the Arctic regions, and returned home with the loss of only five men, he says,—'Nothing could have been better devised than the means made use of in those expeditions to preserve the health of the people. Not only were the conditions of health attended to as regarded the skin, the muscles, the bones, the lungs, and the digestive organs, *but the health of the all-important nervous system* was sedulously provided for, by the constant and cheerful occupation of the people in their various duties and amusements.'

182. Evincing the Nervous origin of febrile diseases, (says Dr. Brown,) 'It is well known that in fevers, and all contagious diseases, a period generally intervenes between the application of contagious matter, and the occurrence of the disease which it gene-

rates, varying in different diseases, and in different cases of the same disease. The latent period of the poison of hydrophobia is probably longer than that of any other disease. The interval from the application of the poison of typhus, to the production of its effects, extends frequently, to three weeks or a month, and even, sometimes, to sixty or more days. In this interval, a great degree of *nervousness*, inappetency, mental dejection, and debility, often precede, for days, or weeks, the symptoms which denote the commencement of the febrile movement in the system. This gentleman believes that *he has observed cases in which the low and exhausting degree of indisposition attending this period, has constituted the greater part of the disease which has destroyed the patient.*'

183. Dr. Williams has written a very interesting essay on Nervous Irritation. 'The functions of animal structure, (he remarks) are relative; certain circumstances excite or increase, and others diminish or depress them: exciting agents are called stimuli or irritants, those which depress are termed sedative. The relation of an irritant to a function is irritation. There is a certain share of irritability, natural to the healthy state of every part, and the moderate operation of natural irritants upon this, constantly, induces that degree of irritation which induces healthy function. Irritation, in a morbid state, implies excess, which, when great, sufficiently declares itself by the disorder or loss of balance that ensues,' &c. Irritation may arise from an excess of irritability in a part independent of external circumstances, so that the ordinary or habitual stimuli become irritants; or it may proceed from an additional irritating influence from without. He instances vomiting, as a symptom of irritation of the stomach, and it may arise from an excessive irritability of that organ, or from sympathetic irritation,—concussion of of the brain, diseases of the urinary organs, pregnancy, &c.; or it may, on the other hand, proceed from the additional irritating influence of an emetic, or of indigestible food.' He notices also, 'Irritation of the intestinal mucous membrane—manifested by diarrhœa, and proceeding from irritating contents of the bowel—the operation of a drastic purgative,—or from the excessive irritability of the membrane, (or rather, of the expanse of its nervous tissue,) as in dysentery, lientery, &c. Again, the urinary bladder shows signs of irritation when subjected to the unusual stimulus of gravel or stone; and the same phenomena are presented when, either from disease in its coats, or by (nervous) sympathy with some adjacent parts—such as stricture of the urethra, or rectum, schirrus (cancer) of the uterus—worms, &c., the .irritability of the bladder is inordinately increased, and it is continually parting with its natural contents,' &c. It is through the medium of the nervous sympathies, which produce what is called constitutional disturbance, that local sources of irritation are most frequently excited. Any thing that disturbs the balance of the functions in general is sure to be felt in the weak or disordered part: and a cause of irritation which may be long latent, during the quiet and equal action of functions, is thus called into activity by any general exciting influence, and if extensive, often acts with great energy on the constitutional disease. The influence of a local irritation frequently extends to other functions affecting them irregularly and singling out a weak organ, which becomes a new seat of irritation, whilst the original evil receives back with interest by the same channels of sympathy the disturbing influence that it had engendered.' This interesting subject, it will be remembered, has been

ably treated by Abernethy, and other eminent writers, and its importance is generally admitted in practice. It clearly sets forth the chain of nervous sympathies which form so prominent a part in Neuropathology.

'The nature of the phenomena of irritation is necessarily obscure, as it is involved in the mystery of the properties of organized matter; and we must therefore rest contented with observing the fact. But there is, he observes, another source of irritation which it is important to notice, equally proceeding from the operation of a prevailing law of organized structure. There is in the living powers a kind of resiliency, or disposition to reaction, which manifests itself after the application of any influence that tends to depress or destroy them. This property often converts sedatives into indirect irritants. Thus cold is in itself a sedative. But the *reaction* which succeeds to its application renders it a fertile source of inflammation and irritation. The worst mechanical injuries, and severe burns and scalds, are likewise sedatives in their immediate effect; and, when extensive, this is sufficiently apparent in the syncope, suspension of sensation, and function, and even death, which they occasionally produce. There are also many other instances on record of death supervening on severe accidents, such as crushing, or tearing of limbs, compound fractures, violent blows on the head, epigastrium, or thorax, &c, in which it could not be ascribed to loss of blood, or even mechanical injury of the vital organs. The death of patients under severe surgical operations, without hemorrhage, may be attributed to the same cause, assisted often by the powerfully sedative influence of fear and pain. He notices, also, the sedative influence of loss of blood, evacuations, and privation of food, as essentially of the same nature, contagious effluvia, malaria, septic, and other pestiferous influences, all of which, if the powers of the system are insufficient to resist or to rally from, they succumb under. This is the very reverse of irritation, yet, strange to say, it has been commonly confounded with it; and it is when applied in this way to such opposite affections that the word has lapsed into an indefinite acceptation. —(See 136. 146—4.)

If the powers of the system are not subdued by the prostrating or sedative influence, there will then be *reaction*, in which they usually tend to pass the limit of moderation and regularity, and irritation and excitement ensue in the functions, various in kind, and degree, according to the share of power which they severally retain. This reaction may be partial and injurious, as where it displays itself in convulsions, vomiting, hiccup, palpitation, cramps, &c. He declares these symptoms, certainly *not to be indications of prostration (as some imagine) in respect of the organs which they affect; in these they are unequivocal signs of excitement, or increased action*, although perhaps they may be admitted to be with regard to the constitution at large. If not seconded by a reanimation of the organs more immediately concerned in the support of life, *they exhaust the excitability of the system*, and accelerate the extinction of vitality.

Another remarkable (nerve) sign of reaction, he observes, is *rigor*, or shivering, teeth chattering, &c. The addition of this sign to those already mentioned implies a greater degree of *power* in the system, and in many instances it precedes the development of the highest degree of reaction. It is noticed as the first sign of fever, and followed by irritative movements of an intense and general kind—and it is also the sign of healthy reaction from syncope, or fainting, and frequently succeeds to the sedative impression of cold. He looks upon it as a slight convulsive motion, the object of which is to give impulse to the circulation of the surface. When *reaction* becomes more general and perfect, it verges on *fever*, which may be *inflammatory* or *nervous* according to the prevailing strength of the sanguiferous, or nervous system. How remarkably do these views coincide with those already detailed under the head of Irritation with vascular fullness and depletion!

184. But not only does Dr. Williams thus extend the hypothesis of nerve irritation to all the maladies here adduced, but he states that it is to the *degrees of nerve irritation short of fever and inflammation that he here restricts the application of the term irritation*, and yet shews that even *in these*, we find many of the functional disorders which attend fever—disorders of the functions of digestion, respiration, and circulation; vitiated excrements, &c., shewing the depraved state of the visceral secretions, the disturbance of the sensorial functions, and the commonly exalted and acute sensations and perceptions, while the other mental powers are below par; hence, irritability of temper, and depression of spirits, &c., and the loss of balance, sometimes amounts even to delirium, which is usually of the morose or angry kind. In all these cases we should err were we to trace constantly the features of excitement. It is the *loss of balance* which is most apparent, and although excitement may exist in one part of the system, the remaining functions will generally suffer from prostration or weakness. Thus, the stomach and bowels may exhibit irritation, in profuse secretions, and inordinate movements, whilst other secretory and motory organs are in a state of complete inactivity and prostration.

185. 'Dr. Williams comprehends in his first class of substances, or those producing direct irritation, all which produce slight mechanical injury—extraneous substances, tumours, effusions, and accidental productions: chemical irritants; too long retained, or vitiated excretions; dentition, crudities, and worms in the alimentary canal; calculus in the urinary or biliary passages, and many others. (See 109.)

186. Speaking of worms in the intestinal canal, he says, they will irritate the membrane of the bowels in every variety of way but a salutary one. Thus they may affect the *nerves*, occasioning, by sympathy, grinding of the teeth, convulsions, disordered appetite, various pains, palpitation, &c. The vascular system may likewise be excited, and mucous poured out in great quantity, the peristaltic motion accelerated—without dislodging the offending bodies; whence diarrhœa, with tormina, (gripings,) depraved excretions, thirst, atrophy, and other constitutional disorders may ensue,'—all which are evidently only depraved action of nerve structure, acting upon parts and organs subservient to its influence.

187. Indigestible food, &c., in the stomach, irritate in a variety of ways. If the sympathies of the muscular apparatus related to it are quick and susceptible, vomiting is excited. If not, the irritation will cause other sympathies, and uncomfortable feelings both bodily and mental: whence arise gastrodynia, (stomach pain,) pain in the chest, incubus, palpitation, asthma, headache, vertigo, hypochondriasis, &c.' Irritation in the bowels may be transmitted to the brain and spinal marrow, and from thence develope its effects on the voluntary muscles, producing spasm, convulsions, chorea, &c., &c. Dentition in children often produces disordered secretion, wasting diarrhœa, atrophy, convulsions, and paralysis. Tumours in the brain or spinal marrow excite epileptic convulsions, chorea,

paralysis, agitans, &c. Accidental productions, as tubercles, produce irritation both local and sympathetic. Thus, in the lungs—they occasion cough; in the bowels—diarrhœa, &c.; whilst their presence almost always irritates the heart and quickens the pulse. Foreign bodies, &c., frequently occasion severe irritation, with little or no inflammation: such are spasm in the part, and disorder of any of the functions in the system, quickened pulse, hurried breathing, impaired digestion, delirium, convulsions, tetanus,' &c.

188. In his second class, in which ordinary circumstances, &c., become a source of irritation by reason of the excessive irritability of the nerves themselves.—'We see,' he says, 'parts sometimes remain permanently irritable without any obvious increase of vascularity; and as there is reason to suppose that *sensibility is not always in proportion to the size of the vessels*, it would not seem just to attribute the excessive irritability of an organ always to inflammation, or even to congestion.' Mr. Travers considers that the irritable joint, breast, testicle, and prostrate gland, give no evidence of inflammation. He records instances of irritable breast, and knee joint, attributed to needles having entered the parts, which continued painful many months, after the extraction of the needles, in the total absence of inflammation. The facial nerves, in those afflicted with tic doloureux, present examples of excessive irritability: a draught of cold air, or the heat of a fire, is enough to irritate them and the adjoining muscles into pain and spasm. The bronchial muscles are inordinately irritable, in those subject to nervous asthma: and trifling causes, such as the effluvia of a stable, (ordinary dust, &c., in the atmosphere,) excite them to spasm. Many other examples might be adduced to illustrate this mode of irritation: particularly in that numerous class in which a congestion, or increased vascularity is the cause of excessive irritability, but it is unnecessary to go further.'

189. Thirdly.—Indirect irritation, or the irritation of reaction. This class, Dr. Williams considers 'as numerous as the sedative or prostrating agencies to which the animal frame is liable. There is probably a successive gradation of conditions from the slightest sign of partial reaction from the state of prostration, such as vomiting, rigor, and convulsion, up to a decided and violent reaction *bordering* on inflammation and fever. Sometimes it is confined to a single organ, whilst other organs remain in a state of prostration. Thus the stomach shews it by vomiting, the diaphragm by hiccup, the brain by delirium. Of this description, is the effect of violent and extensive injuries and burns, &c., in which the powers are almost overwhelmed by prostration, and the partial effort at reaction, instead of counteracting it, contributes to render it complete and fatal. He remarks that 'vomiting is one of the most frequent, solitary symptoms of the irritation of reaction, is often indomitable to the last, and greatly hastens the fatal event. A low delirium, with various hallucinations of the perceptions, may equally accompany this state. Convulsions arise in the same way, and produce similar effects. Such is exhaustion, with the lowest signs of reaction. In other cases, irritation takes a larger share in the diseased state consequent on the injuries under consideration. Thus, after rigors, the pulse may become sharp and bounding, with throbbing in the head, eyes glassy, pupils contracted, &c., *delirium* fierce, or there is great restlessness, and morbid sensibility: *spasms* may occur in various parts of the body: there may be *pain* in all degrees, and

positions, the heat may be partially increased although the extremities are generally cold. Here, although beginning in prostration, the chief features of the disease, are those of misdirected and excessive reaction. *They border very closely on fever, and inflammation; and it would be rash to say that they are always distinct from these states.* But although the delirium and exalted sensibility are sometimes so marked as to give suspicion of phrenitis, (inflammation of the brain,) examination of the brain, after death, discovers no sign of increased vascular action further than some turgescence of the vessels, which is totally disproportionate to the intensity of the symptoms.' If this gentleman had only boldly ventured with these views into the pathology of inflammation and fever, the author of this essay would have had scarcely any plausible ground for penning the present volume, so extensive is the basis of his hypothesis.

He further shews, that 'the continued impression of a sedative, or prostrating influence, renders reaction imperfect, and converts it into an injurious irritation. After the first shock of any severe injury, &c., the depressing action may be prolonged by some additional influence, bodily or mental. Fear and anxiety are most powerful in this way, and instances are on record in which operations, trifling and favorable in their surgical relation, have led under this influence, to a fatal result. Women have died after successful, and natural parturition, barely from the effect of a *presentiment* that they would die. Mark the truly nervous character of all these phenomena!

190. He also adduces the most remarkable (well known) causes of irritative action, those which depend on inanition, whether arising from blood-letting, or other evacuation, or from imperfect nutrition. When irritative reaction comes on, there is palpitation of the heart, quick, and jarring pulse, throbbing of the carotid and other arteries, &c.; sensibility is increased, there is intolerance of light and sound, pain, throbbing, and noises in the head, an excited state of the mind, sometimes amounting to delirium, a loaded tongue, and general disorder of the secretory functions. 'Here,' says he, 'is great excitement and disposition to act, but no power to regulate or support it; here, are the nervous phenomena of inflammation without that permanent, and powerful state of the vessels which can lead it to any of its usual terminations.'—(137, 138. 170.)

The cases of delirium, mania, and increased sensibility in those suffering from privation of food, &c., &c., recorded by Drs. Currie, and Latham; Andral, and others, are obviously, of the same nature as this irritation of reaction.

CONGESTION AND DETERMINATION CORROBORATIVE ALSO OF THE FOREGOING VIEWS.

191. In speaking of determination of blood to a given part, Dr. Barlow says, 'Congestion is more or less a passive condition,—determination is always active. When congestion takes place in any part, its origin must be ascribed to some weakness of the vessels of the part, causing them to yield to the ordinary force of circulation; in determination, vessels which would resist the ordinary force of vascular impulse may become over distended by increase of momentum,' &c.

The relative facility of yielding to distension, thence arising, whether natural or acquired, may influence the locality of the determination; *or this may be directed by various sympathies, and nervous connexions*, and also by some peculiar property of the stimulus which produces the vascular excitement. *Some determinations are solely attributable to nervous sympathy*, as those which occur in health under mental emotion. In blushing, for instance, there is obvious determination of blood to the cheeks; nay, when intense, to the whole neck and breast.

192. *It is perhaps*, (he observes,) *from the influence of the nerves in giving determination, that certain stimulants determine blood more particularly to certain organs ;* some causing blood to flow more particularly to the brain, while others tend to induce vascular fullness, in the liver, or in other parts.'—(En. P. M. Vol. 1, p. 528.)

193. Further shewing that the same condition of nerve exists in determination of blood as in a more intense form obtains in inflammation,—(he goes on to say) 'As determination may ensue upon congestions, so may it be followed by, or pass into, inflammation—*of which indeed it seems to be an essential constituent.* But as congestion does not necessarily produce determination, neither does determination pass necessarily into inflammation. Such determination, though an advance towards inflammation, and prone to pass into it, may yet exist so as to constitute formidable disease, and thus continue for an indefinite time without inflammation ensuing. When cases of congestion, kept up by determination, are treated as subordinate degrees of inflammation they yield readily, and to a practice less active than inflammation would require, but when from the absence of purely inflammatory symptoms they are referred to debility, or some unexplained nervous derangement, *and are in consequence treated by stimulants, they rather become aroused into inflammatory action*, which perhaps is in such cases the happier result as they then become treated aright.

194. The nervous origin of disease is, we think, admirably supported by the fact of the transmission and metastasis of various morbid affections from one part of the body to another, and in some instances even effecting the cure of an old malady by the intervention of a new one. 'The supervention of an affection of the skin, (observes Dr. Conolly,) is frequently observed to effect a cure of the internal disease.' Even a febrile disorder of the constitution has sometimes been considered capable of producing, (and indeed often observed to produce,) curative effects. Celsus enumerates among the accidental circumstances which cure the sacer ignis, the 'uno die febris,' or a day's fever. Hippocrates relates the fact of convulsions being dispersed by fever—and even epilepsy removed by the intervention of an intermittent. Chronic glandular disorders, sometimes have disappeared, and old enlargements of the glands have seemed to be removed by an absorption induced by the fever attendant upon measles,' &c. There are also other cases in which a new disease being grafted upon the old one only hastens its victim the more rapidly to its fatal termination. Such instances occur in the latter stages of many protracted and yet fatal chronic diseases—as diarrhœa in the last stage of phthisis—indomitable vomiting, or delirium, &c., which occur at the close of violent injuries, or burns—collapse, and almost all cases of fatal prostration.

195. Lastly, on this head of evidence adduced in corroboration of the views herein contained, we refer to the changes which take place in the animal economy as set forth by Dr. P. M. Roget, Sec. R. S., &c., and shewing the importance of the Nervous system in all the functions of animal life. He shews, among many other interesting particulars, 'that the general structure of man becomes more and more condensed—that the propor-

tion of fluids in each organ, and in the body generally, diminishes, as we advance in years, and that the secretions partake of the general diminution of fluidity incident to old age, and are considerably more scanty than in the early periods of life. Grey hairs, the proverbial attendant upon age, exemplify the operation of the same principle of defective nourishment and suppressed secretion. The heart, diminishes in size and energy, the pulse becomes more languid and slow, and occasionally intermittent, indicating the diminished irritability of the system. In old persons the number of pulsations in the minute often does not exceed fifty, and is sometimes even less than this. Less blood is sent to the different organs; secretion, nutrition, and the removal of the waste material of the frame are all diminished—the muscles waste and become more condensed, and less under control; the glands are more or less absorbed, adipose substance is removed, and the bones are rendered thinner, and more brittle,' &c. 'Now,' he remarks, 'the whole series of phenomena that characterize the decline of life, *indicate the gradual diminution of the energy of the nervous system* in general, and of the brain more especially, and it is found that these organs do gradually decay as life advances. All the sensitive functions are performed less perfectly. The organs of the external senses become less capable of receiving impressions; the nerves transmit more tardily and more feebly their impressions to the brain; and the perceptions to which the transmitted impressions give rise are less vivid and more transitory than formerly. The general sensibility of the system is diminished, bodily sufferings are less acute—the powers of the mind are also diminished, sight and hearing fail, and all the other senses which connect us with the external world wither and decay. Let us enquire whether it is possible throughout the multifarious changes we have described as characterising the several stages of transition from infancy to decrepitude, to discover the uniform and progressive operation of any single principle.'—'*May we not ascribe the diminution of the force of circulation to the gradual loss of muscular power arising from a decline in the energies of the Nervous system?*' 'If this be a legitimate inference, then *this declension of nervous power* which takes place with more rapidity as we advance in life, appears to be the general principle we are in quest of:—*that is, the ultimate fact to which all others are subordinate.*'

ANATOMICAL AND PHYSIOLOGICAL EVIDENCE.

196. Previous to the discovery of the 'Circulation of the Blood,' by Haller, many were the guesses, and opinions—theories and views of medical authorities—concerning the circulation, and the mode of nutrition, &c.; but on the promulgation of this discovery, all unfounded dogmas and absurd opinions lay prostrate, and Science began to rear its head upon a new and incontrovertible basis—the Foundation of Fact.

In these days, those who would set aside the well-established Truths of Physiology—the discoveries of the functions of the Nervous System, and its evident priority in the motions, functions, and general phenomena of life, so far as already discovered—would attempt to destroy and annihilate the facts—the indefatigable labours of the talented men of Science, for whole centuries. They would set at naught all the mass of evidence and experimental truth which for ages has been accumulating, and endeavour to bring back Medical Science to the visionary hypotheses of 'old wives fables,' and the low, grovelling dogmas of practical Quackery.

It is only, in so far, as Medicine is built upon the incontrovertible facts of Anatomy, Experimental Physiology, and Chemistry, &c., that she is able to rise above the base pretender, and the charlatan.

As regards Nervous phenomena, they would set aside the only functions and uses to which nerve structure has been, in all discoveries, shewn to be by Infinite skill and wisdom, adapted and designed; and deny, at least, the necessity of existence for one portion of this interesting part of the system, for any known purpose in the animal economy. The doctrine advanced by a modern, learned physician, that the variable states of the atmosphere *affect the respiratory organs, and through them the blood, and through that fluid the energy of all parts of the system*, appear to us as tending most remarkably to the undesirable results above stated—but its absurdity becomes fully manifest in the light of Anatomical and Physiological research.

197. The great system of the circulation of the blood is described by anatomists as composed of three parts—the heart, the great vessels and branches, and the capillaries.

The whole of this system is demonstrated as conspiring to produce one grand effect—the Nutrition and Removal—the waste and supply of all organized tissue. To this may also be added, the supply of animal heat to the body, &c., and the chemical phenomenon—the excitation of Nervous energy. The furnishing of that fluid which is necessary to the excitation of the several functions of the frame, is also performed by these organs, as well as the removal of carbonic acid gas out of the frame, and the transfer of that all-important gas (oxygen) to each organ previous to the exercise of its functions, which appears to play so extensively and vitally important a part in the entire animal economy.

198. On the other hand they demonstrate the nervous system as the organ of all *sensibility*, of consciousness, motion, and function, the chief seat, or head quarters of which is the brain. Bichat says, (page 324, General Anatomy, &c.) 'The brain is in general intended for three important purposes.—1st. It receives the impressions of the external senses, and is, in this respect, the focus of perception. 2ndly. It is the principle, the centre of voluntary motion, which cannot take place without its influence. 3rdly. The intellectual phenomena are essentially connected with the regularity of the life of this viscus, it is the seat of them,' &c.

The power of consciousness is on all hands ascribed to this organ.

SENSATION.

199. Sensibility is nowhere contemplated as arising from, or being conveyed through the medium of the vascular system, or in anywise through "the blood;" but from the peculiar nervous structures, or organs, constructed for this purpose, which form the medium of communication with the external world, &c.,—the eye, the ear, the organs of smell, taste, touch, and superficial sensibility or feeling which latter is formed by the expansion of the nerves of sensation over the entire surface of the body.

Physiologists have shewn that all nerves of sensation preserve their sensitive power only so long as they maintain nervous communication with the sensorium. '*That these are likewise the organs which convey a con-*

sciousness of pain to the cerebrum, and that when pain is felt, it must be attributed chiefly to association with these nerves.'

MUSCULAR ACTION.

200. The muscular system is divided into two parts—the one of animal life, or the voluntary muscles—the other of organic life; such are the heart, stomach, bladder, uterus, &c.

'Every thing in the phenomena of animal contractibility (says Bichat) proclaims the influence of the brain.' 'Distant from almost every muscle, the brain communicates with, and transmits its influence by means of, the Nervous system. Now these communications are effected in two different ways.—1st. There are nerves that proceed immediately from the brain to the muscles of animal life. 2ndly. The greatest part do not proceed from the organ itself, but from the spinal marrow. Almost all the muscles of the neck, all those of the chest, of the abdomen, of the limbs, borrow their nerves from the latter source. The spinal marrow is, as it were, a general nerve, of which the others are the principal branches and divisions. All injuries sustained by this essential nerve, are felt by the muscles that are under its influence. The higher the injury sustained by the marrow, the greater the danger; its influence in the lumbar region bears upon the inferior extremities, and the muscles of the pelvis only. In the back, it is followed by paralysis, both of these muscles, and of those of the abdomen. Now, as these contribute directly to respiration, this function begins to be obstructed: if the injury be above the dorsal region, respiration will be still more difficult, because the intercostal muscles have lost their powers; the diaphragm alone maintains the action, because the nerve which ministers to it, still receives and transmits the (Nervous) influence. If the injury happen to be above the origin of this nerve, there is an end to the action of the diaphragm—respiration ceases, and circulation is therefore interrupted. This explains why the dislocations of the first vertebræ over the second are instantly fatal.

After describing some experiments, illustrative of these statements, he observes, 'From all these facts, the influence of the spinal marrow upon motion, the principle of which it receives from the brain, and subsequently transmits to the nerves, *cannot, I think, be doubted.* These transmit to the muscle that principle they have received, either through the intervention of the marrow, as in almost all those of the trunk, and the limbs, or directly from the brain, as in those of the face, &c. There are other *proofs* of this influence; the tying, the division, or the compression of a nerve, will paralyze the corresponding muscle, or that which it supplies. If a nerve, laid bare in an animal be irritated by any means, spasmodic contractions are instantly produced in the muscles'.

NERVOUS INFLUENCE UPON THE MUSCLES OF ORGANIC LIFE.

201. These muscles, in respect of volume, are remarkably different to the preceding. They occupy the centre of the trunk, do not interfere with the limbs, are chiefly involuntary in their action, and are secured from external injury; on the other hand, those of which we have been speaking form, almost entirely, the limbs and the external of the trunk, or about one-third of the whole frame, (Bichat,) and appear to be designed to protect the other organs in that locality, as much as to perform the various motions of the animal. The chief muscles of organic life are the heart, the œsophagus and gullet, the muscles of

the bronchi, the stomach, the intestines, the bladder, and uterus.

202. Bichat, after showing how slightly the organs of organic life are connected with the brain, comes to the conclusion, 'that we are completely unacquainted with the influence of the brain and the nerves upon these muscles; that it does not operate as upon the voluntary muscles. It must, however, (says he,) exist to a certain degree, since the *nerves* that enter into the composition of these muscles *must infallibly be intended for some use.*'

He shews, (p. 424.) 'that the heart, the stomach, the rectum, and the bladder, are evidently partly supplied with cerebral nerves—to some extent—the two latter organs approaching nearer to voluntary muscles.'

203. He also concludes, (p. 431.) 'Every organic muscle has a body which is always in contact with it, and keeps up its motions in the same manner as every animal muscle, incessantly connected with the brain, borrows its power of motion from that organ.' (p. 432.) 'That organic sensibility, is strongly characterized in the muscles of organic life: it must exist before the sensible organic contractility can be developed; but these two properties are never separated, but succeed each other in their exercise,' &c. He shewed 'that on the action of excitants upon them, in part depends the phenomena of the organs; they stimulate the muscles which, without them, would be immoveable; they are to these organs, as it were, what pendulums are to our machines; they give the impulsion,' and, therefore, are not the weights that really keep the whole in motion. These excitants are, the blood for the heart, urine for the bladder, food for the gastric organs,' &c.

204. That the heart contracts by the stimulus of the blood there can be no doubt. This was shewn in our own country more than half-a-century ago, by Bell, Monro, Hewson, and others. These anatomists also demonstrated the nerves of the heart, as from the par vagum, and great sympathetics. 'That these nerves, (remarked Bell,) conduce powerfully to move the heart, is the opinion of eminent anatomists, from a consideration of the common nature of muscles, and from the increase which follows in the heart's motion by irritating the eighth pair of nerves either at the brain, or the spinal medulla, and the languor that ensues upon tying these nerves, which proves fatal either suddenly or in a few days,' &c. 'The continuance of action of the heart, when removed from the body, is only in common with other parts in unison with the laws of ganglionic phenomena.'

205. Dr. Carpenter states, (353) 'In the ordinary action of voluntary muscles, the *nervous system* is always the channel through which they are called into play, whether to carry into effect the determinations of the mind, or to perform some office necessary to the continuance of life, such as the movements concerned in respiration.' With regard to the involuntary muscles, 'their actions are ordinarily executed in respondance to stimuli applied to themselves.' 'It is, says this author, so difficult to excite contractions in them through the medium of the nerves, that many Physiologists have denied the possibility of doing so; and the *nerves* lose their power of conveying the influence of stimuli very soon after death, although the contractility of the muscles may remain some time. *The nerves of these non-striated muscular fibres are chiefly those belonging to the sympathetic system, but as it will be hereafter shewn, those which excite motion, are probably derived, in reality, from the Cerebro-spinal system,' &c.*

GENERAL NERVOUS ACTION.

206. Dr. Marshall Hall, has succeeded in establishing one of the most extraordinary and yet pathologically important Laws of Nervous Physiology—a law which throws considerable light upon the origin of a variety of diseases, previously occult and unknown. He has shewn that the portion of the spinal marrow which is not occupied by nerves of voluntary motion and sensation, going forth from, or returning to the brain, and which he denominates 'the True Spinal System,' contains an independent nervous centre, whose office is to receive impressions independently of the brain, and preside over the involuntary motions of the body—motions that take place without the influence or cognizance of the will or senses. He shews, 'that this great principle is illustrated in the movements of decapitated animals. When the head of a kitten, or tortoise, is removed, and one limb irritated, that, and the other limbs, are immediately moved with great energy. Here motion was induced by the irritation of the limb, and produced when the brain was removed.' Again :—'If we irritate the nostrils, or the palatine fringes of a decapitated turtle, we excite, through the trifacial nerve an act of inspiration, &c. This, and other experiments, he contends, prove without one word of argument, the existence of *incident* nerves, possessing the special *excito-motory property*.'

'By the cerebral system, (he observes,) we are placed in relation to the external world *psychically*, or *mentally* ; by the true spinal system, we are placed in a similar relation *physically*. As by the former we imbibe all our ideas, *so by the latter we appropriate external objects to our very substance*. On the true spinal system, all ingestion, all retention, all expulsion, in regard to the animal frame and economy, depend.'

Not only respiration, but all the functions of ingestion, and of egestion, are of the same character :—they are all spinal :—they are all movements of which the vis nervosa is the agent, the incident and reflex nerves in their connection with the true spinal marrow the media, and the reflex action the form.

He observes, (536.) 'The Cerebral system is concerned with *Psychical or mental acts*—the true Spinal with physical acts on the masses of bodies to be appropriated to, or expelled from the animal economy, while the Ganglionic system relates to *the chemical changes* in the disposition of the atoms of the animal body, its solids, fluids,' &c.

207. As the true spinal system, then, governs the ingestion, and egestion of masses, in regard to the animal economy, so the ganglionic regulates the interstitial absorption, deposition, re-absorption, and the secretion of the atoms or particles of which the animal frame is composed, and of the ingesta and egesta.'—(538.) (At 554.) he says, 'The Vis Nervosa is, I believe, demonstrably the source of the excited reflex actions, and functions. The same power is probably in its direct or immediate influence, the source of the movement of the internal organs—*the heart, the stomach, the intestines, &c., the organs of secretion, of nutrition,' &c.* There is, he observes, (548,) 'An internal nerve for formation, nutrition, secretion, &c. This nerve is ganglionic. There are external organs and structures requiring nutrition, &c. There are also external nerves. The internal ganglionic nerve is purely nutrient : its ganglia are simple. The external involve sentient, and I believe excitory nerves, with the nutrient,' &c. 'The distribution of the trifacial nerve to the lachrymal, paro-

tid and submaxillary glands, *can only be for secretion.*' He also (552,) refers to a branch of the trifacial nerve discovered by M. Arnold, and 'enquires what can its function be, in this situation? It cannot be touched. It cannot then be for sensibility. It cannot be for excited motion. It can only be for formation, for nutrition,' &c. 'Notwithstanding all that has been done in regard to the influence of the pneumogastric nerves, on the secretions in the lungs, stomach, &c., this question is still unsolved—still subjudice; and new experiments are required to determine accurately the action of the pneumogastric nerves, and of the ganglionic system, on secretion,' &c.

208. Dr. Hall 'views the motion of the heart, stomach, and intestines, as depending upon the *true spine*, and the ganglionic system, under the immediate influence of the vis nervosa and the irritability of muscular fibre.'

209. We have only need to refer to Dr. Hall's work, to observe what a vast amount of diseases arise out of the disorders and derangements of this true spinal system. All spasmodic diseases, such as convulsions, crowing inspiration, sneezing, asthma, vomiting, globus hystericus, hiccough, tetanus, cramps, colic, &c., are illustrations of excito-motory action.' ( )

210. We spoke of a nervous armour, (56) and of certain orifices &c., guarded by it, (57,) says Dr. Hall, (263.) 'In regard to the idea of a system of excitor nerves constantly operating in the animal economy, preserving its orifices open, its sphincters closed, and constituting the primum mobile of the important function of respiration.'—'the acts are so familiar to us, that we have thought them understood when the nervous agents through which they have been excited have not even been detected. Yet that this view is the true one is proved by the most decisive experiments.'

The guards of orifices specified by this author are—(1.) The trifacial, guarding the eye, nostril, ear in the cetacea, the fauces. (2.) The pneumogastric, guarding the entrance to the windpipe, the bronchia, the gullet, the cardiac orifice of the stomach, the ureters (or urinary tubes,) the gall ducts. (3.) Guarding the rectum, bladder, seminal vessels, and uterus.'

211. Dr. Quain says, 'The nervous system may with great propriety be said to preside over all the leading functions of the economy; for it would be restricting its influence to a very narrow limit, were we to say that it merely receives impressions from without, and transmits volitions from within: its dominion extends much further. When we see a limb deprived of sensation and motion by an apoplectic seizure, we at once admit that these powers are dependent on nervous action: and we cannot but infer that nutrition and animal heat are equally so, when, at a subsequent period, we find it wasted, and reduced in temperature. All persons are aware how the secretions may become deranged and vitiated by injuries of the spinal cord: that of the kidneys, for instance, becomes small in quantity, turbid and ammoniacal; digestion is suspended by the section of the vagus nerves, and the researches of Le Gallois, and Wilson Philip, have shewn how the circulation is affected by and through the Nervous influence.'

212. Professor Müller declares in his Elements of Physiology, (p. 52.) 'It is in the nerves that the mobility of the organic forces, without motion of the ponderable masses is most manifest; *their operation is necessary for the exercise of all the functions of the body*, since all parts of the system through the medium of changes produced in the nerves, react on the brain and spinal marrow, and receive from

these organs certain influences necessary for their peculiar actions.'

213. 'The digestive process,' he states, (p. 596.) 'is nearly entirely arrested by the division of the vagus nerves on both sides (see 23,) Blainville, having performed the experiment on pigeons, observed that the vetches, which they swallowed afterwards, remained unaltered in their crop, and that the process of chymification was wholly arrested. The same result attended similar experiments by Le Gallois, Dupuy, Dr. Wilson Philip, Clarke Abel, and Hastings.'

NUTRITION.

214. He also instances several beautiful experiments, evincing the influence of the nerves in nutrition. 'Thus he observes, the change of form which the nervous system undergoes in insects during their metamorphosis, and that in exact relation to the organs of the creature in its future state. In the caterpillar, the ganglia of the nervous cord are nearly uniform, corresponding with the segments of the body: but during the metamorphosis, when individual parts are more developed, and the legs and wings are formed several ganglia become united into larger masses opposite the points where the new organs are developed. During the transformation of the larvæ of the frog, the tail disappears, and with it the extremity of the spinal cord, while simultaneously with the appearance of the extremities their nerves are developed. In an experiment upon a salamander, quoted by him, after the end of the tail had been removed, a wire was thrust half an inch up the spinal canal, and moved about in it so as to destroy the cord; after the lapse of nine weeks a new portion of tail was produced scarcely more than an eighth of an inch in length: while in another salamander of the same size, and placed under the same circumstances, with the exception of the injury to the spinal marrow, the new portion of the tail produced was half an inch in length. He instances many other experiments (some of which are already recorded herein,) and comes to the final conclusion that there is no proof that the sympathetic nerve has a more especial influence on nutrition than the cerebro-spinal nerves, except, perhaps the fact that the nutrition of a part does not cease, when the nerves, which it receives from the brain and spinal cord are divided.'

ACTION OF THE HEART.

215. 'The heart, he observes, is not so much dependent on the influence of the brain and spinal marrow, that the removal of these organs immediately annihilates its power of motion. The cardiac nerves, under such circumstances, still retain a portion of the motor influence; and *even in the small part of these nerves which can be retained in a heart cut from the body, there still remains sufficient nervous power to enable the organ to continue its motions for a short time.* But the brain and spinal marrow, must nevertheless be regarded as a principal source of the nervous influence: for their destruction enfeebles the heart's action to such a degree, that, although it is continued for a considerable time, its force is not sufficient to keep up the circulation.' He says, however, (p. 209) 'The constant source of the heart's contractility is therefore, primo loco, the motor power of the sympathetic nerve.' &c.

216. Professor Müller has also shewn, that 'all the parts of the system that are supplied with motor power by the sympathetic nerve, still continue to move, though more feebly than before, when they are separated from their natural connexion with the rest of the sympathetic sys-

tem, and wholly removed from the body. Of these he enumerates the heart, the peristaltic motions of the intestines,' and Dr. Hall, also adds 'the æsophagus to this number, whose contraction after removal he has himself witnessed.' Müller also shews, that 'the movements excited in organs under the influence of the sympathetic nerve, are not transitory and momentary contractions: they are either enduring contractions, or they consist of a long continued modification of the ordinary rythmic action of the organ. (61.) Thus the momentary application of a stimulus to the heart, excites a continued series of periodical beats.' Moreover, it is not very evident, how this organ could possibly obtain vital power for the continuance of its action, by connexion with the nervous system, when respiration, or the source of nervous energy, or vital force (5, 6, &c.) has ceased, the blood has become in some measure congealed, and vitality destroyed: greater than, when the heart, so wisely constructed with local nervous ganglions in its own structure, is entirely removed from the body. It is also to be borne in mind, that the action of this organ when removed from the body, is much more feeble and transitory, than when all the functions necessary for the continuance of vitality, and the vis nervosa are maintained, artificially, or otherwise. As it is discovered, also, that every organ in the animal frame is supplied with nerves of one kind or other, it is evident, as Bichat remarked, 'they must infallibly be intended *for some use,*' and we are aware of no other action or function to which they could contribute in this organ (independently of its nutrition,) than to its muscular contraction and dilatation—and therefore, if for any use, must minister to the motory functions of this important organ. It is also discovered that the involuntary operations of the Invertebrate animals, in which the spinal column is wanting, are performed by various ganglia, which are usually disposed in the vicinity of the organ which they supply.

The splendid facts brought before us by Dr. Hall, assign the action of this organ with, indeed, all involuntary motions, to their communication with *the true spinal marrow.* And, indeed, although the heart has been known to beat for some time after its excision and isolation from the body, yet, as witnessed by Dr. Hall, the æsophagus, when removed from the body of a rabbit entirely, continued to exhibit a peristaltic movement which gradually expelled a portion of food. Dr. Hall, therefore considers æsophageal deglutition to be partly reflex, and partly due to the immediate excitement of the irritability of the muscular fibre.'

That the action of the heart is continued in some instances for a considerable period after its disconnection with the body, and its ordinary stimulus the blood; by no means proves that this is not owing to the nervous filaments or ganglia interwoven in its structure; but it is, at all events, a wonderful provision of Infinite wisdom for the prolongation of an action, whose continuance is life—and cessation—death.

SECRETION.

217. This physiologist shews that Krimer performed experiments upon the urinary secretion. When the nervus vagus was divided the secretion did not cease, but became of greater specific gravity from containing serum of the blood. When the divided nerves were connected with the galvanic pile the urine reacquired its normal character. 'On a first view, he observes, the cerebro-spinal nerves, as well as the sympathetic, appear to have the function of

regulating the secretions; but maintains, that, in these instances it is probable, that the former are accompanied by fibres of the sympathetic, which appear to hold these functions in its control.' 'Daily experience, observes this physiologist, affords us many proofs of the influence of the nerves on secretion. We know that during the depression of the nervous system in the cold stage of fever, not only the quantity of the secretions, but also the proportion of their natural ingredients are diminished,' &c. 'We also know that dryness of the mucous membranes, and of the skin, are often signs of depressed nervous influence in acute diseases. How frequently, too, do we observe the influence of passions of the mind on secretion; for example, on the secretion of tears, of the bile, and the milk, and even on the secretion and other conditions of wounds. It is a well known and undoubted fact, that not merely the presence of food in the mouth causes an increased flow of saliva, but that even the sight of savoury food excites the salivary secretion. I am far from believing, (says he,) that the *power of chemical action* which the glandular substance owes to its vital condition, has not as equally important a share as the nervous influence in the process of secretion; but it is *probable that the influence of the nerves is necessary for the support of this chemical action*, which in each gland is different.' 'That the cerebro-spinal nerves are accompanied by fibres of the sympathetic, Retzius has shewn to be the case with the second branch of the fifth nerve in brutes, and in them it is evident, also in the case of the nervus buccinatorius, *on the surface of which may be traced many grey nerves, derived from the otic ganglion.*' (Müller, p. 517.) With reference to the actions and vital properties of the grey organic fibres, two opinions may be held. According to one opinion, the fibres in question, together with the globules of the ganglia, rule over the involuntary movements; according to the other, they preside over nutrition, secretion, and the chemical processes generally. 'The nerves have a most marked influence on the secretions,' and he shews, that 'if there were but one kind of nerve for the regulation of the movements, and the chemical processes, the increase of a secretion, by nervous influence, ought to be always attended with spasm, and spasm with increased secretion, and yet the two phenomena are often met with separately. He considers it much more probable, that the grey organic nerves regulate the organic processes of nutrition and secretion, and that they receive from the motor roots of the spinal nerves, motor white and tubular fibres, on which the involuntary motions must be dependent.' 'If this be really the case, the motor nerves of the heart ought to consist principally of the white tubular fibres—and such is the fact.' Grey fibres can be traced distinctly to the mucous membranes of the mouth and nose, and no involuntary motions are performed by these tissues is evident. 'If we compare the cardiac nerves with those that supply the secreting viscera, the much greater tendency to the *formation of ganglia* in the latter nerves will strikingly distinguish them from the former." Remak has, however, since shewn, that the nerves within the substance of the heart consist of the same organic, knotted fibres as the branches of the sympathetic in other viscera.—And Müller appears, in consequence, to have changed somewhat his opinion. These cardiac ganglia may only subserve the purpose of nutrition.

DIGESTION.

218. The great physiologist, Majendie, in his Compendium of Physiology,

(page 294,) remarks—" In a purely physical point of view it has been pretended that Digestion is under the immediate influence of the brain—and that if the hemispheres should be removed that this process would be entirely abolished. I have never seen this phenomena: on the contrary, I have seen digestion continue in animals from which I have removed the brain almost entirely.—Water dogs, from which I subtracted the brain and a great part of the cerebellum survived eight or ten days, *and digestion went on very well.* But they had lost the instinct of seeking for food—and several even had lost that which accomplishes deglutition. I was obliged to make them swallow artificially. Wounds of the medulla oblongata and of the spinal marrow, injure deglutition much more than digestion; but as they impair the respiration and circulation it is *scarcely probable* that they directly influence digestion, but act on the contrary in an indirect manner through the medium of the great functions indispensable to life." Further.—" That mysterious organ which Anatomists name the great sympathetic nerve has its principal ganglion and plexus behind the stomach and intestines, and a great number of its filaments pass to the digestive organs. It is *probable*, therefore, that digestion is influenced by the great sympathetic nerve."

219. The physiologist, Dr. Carpenter, observes, (928) " The sympathetic nerves possess a certain degree of power of exciting muscular contractions, in the various parts to which they are distributed. Thus, by irritating them immediately after the death of an animal, contractions may be excited in any part of the alimentary canal— in *the heart* after its ordinary movements have ceased—in (the large artery) *the aorta*, the vena cava, and the thoraic duct--in the ductus choledochus, uterus, fallopian tubes, vas deferens, and vesiculæ seminales. But the very same contractions may be excited, by irritating the roots of the spinal nerves, from which the sympathetic trunks receive their white fibres; *and there is consequently strong reason to believe that the motor power of the latter is entirely dependent upon the Cerebro spinal system.*"

220. He remarks, (372.) " *The Nervous system, taken as a whole,—is the instrument of all those operations, which peculiarly distinguish the Animal from the Plant;* and it serves many additional purposes connected with the organic, or vegetative functions, which the peculiar arrangements of the animal body involve."

221. He continues, (929) "It is difficult to speak with any precision as to the functions of the sympathetic system. There is much reason to believe that it constitutes the channel through which the passions and emotions of the mind affect the organic functions; and this, especially, through its *power of regulating the calibre of the arteries.* We have examples of the influence of these states upon the *circulation* in the *palpitation of the heart, which is produced by an agitated state of feeling;* in the *syncope* or suspension of the heart's action, which sometimes comes on from a *sudden shock;* in the *act of blushing and turning pale*, which consist in the dilatation or contraction of the *small arteries*, in the *sudden increase of the salivary, lachrymal, and mammary secretions under the influence of particular states of mind*, which increase is probably due to the temporary dilatation of the arteries that supply the glands, &c. It is *probable* that the *sympathetic system* not only thus brings the organic functions into relation with the Animal, but that it also *tends to harmonize the former with each other, so as to bring the various acts of secretion, nutrition,*

&c., into mutual conformity. Of the distinctive functions of the *grey or organic fibres we have no knowledge whatever. Possibly they may have some direct influence upon the chemical processes, which are involved in these changes, and may thus affect the quality of the secretions,* whilst the office of the white fibres is rather to regulate the diameter of the blood vessels supplying the glands, and thus to determine the *quantity* of their products."

222. Before concluding this part of our subject, however, we cannot help noticing some extraordinary, and apparently contradictory statements made by Dr. Carpenter, in his Manual of Physiology, (840,) entitled "General View of the Operations of which the Nervous System is the Instrument."

a. First of all he says, "The Reduction of the food in the stomach, by the solvent power of the gastric fluid is a purely *Chemical operation* with which the Nervous system has nothing whatever to do," with the exception only of the muscular movements of this organ. If this statement were correct, then, Dr. Cullen, and all those Medical Authors, who have placed dyspepsia, (indigestion,) gastrodynia, (painful digestion,) and other diseases of this organ, in the class of Neuroses, or Nervous diseases, have made an egregious blunder. The experiments also of those Physiologists who have shewn that digestion does not ensue when the eighth pair of nerves is divided, except when a galvanic current is substituted for the loss of the "vis nervosa," must go for nothing. But let this author answer his own statement in the language just cited, and especially that in which he says, (929,) "Of the distinctive action of the grey or organic fibres *we have no knowledge whatever.* Possibly they may have some direct influence upon the *Chemical processes* which are involved in these changes," ("secretion, nutrition, &c.")

223. *b.* Again, he continues, "With the process of *absorption* by which the *nutritive materials* with other substances are introduced into the vessels, the Nervous system has nothing to do: this being purely a vegetative operation, partly dependent upon the simple physical conditions which produce Endosmose, and partly on a process of *cell growth.*"

c. "The *assimilation* of the new material, effected as we have reason to believe by another set of independent *cells*, can receive but little influence from the Nervous system, and is obviously capable of taking place without its aid."

f. "The same may be said, (he observes,) of the Secreting operation in general, which consists of the separation of certain products from the blood by cells situated upon free surfaces; which thus remove the products from the interior of the fabric."

e. The act of *Nutrition* (also) in which every tissue draws from the circulating blood the materials for its own continued growth and developement, &c., he denominates, "a process of *cell* developement and metamorphosis, which must be from its very nature independent of Nervous energy'."

h. "The developement of the *Reproductive* germs in the one sex, and the ova within which these are to be evolved in the other—the subsequent fertilization of the latter by the former, and the changes consequent upon that act, together making up the function of *Reproduction* may be all regarded as modifications of the ordinary Nutritive processes, and are effected, like these, by the inherent powers of the parts concerned in them at the expense of the materials supplied by the blood, without any direct dependence on the Nervous system."

224. Certainly it appears strange that a Physiologist whom we have seen just now candidly avowing, that (929,) "it is difficult to speak with any precision of the functions of the sympathetic system," and again "of the grey or organic fibres we have no knowledge whatever."—should in the phenomena before, us possess such clear views, and be able to draw such positive conclusions, concerning the offices and functions of these nerves as to declare, that they have really nothing whatever to do with the intensely important phenomena of the organs which they supply. Such gratuitous assumptions, after such a candid avowal, are only calculated to unhinge the minds of students without any good and sufficient reason, and to throw a veil of unwarrantable mystery upon the opening germs of Science. The statements are gratuitous, inasmuch, as in the early periods of Reproduction, no microscope has ever been able to disprove the existence of nerve structure, or the operation of nerve power, even in the most gigantic cell ever presented, for nerve structure itself primarily assumes the form of cell life. (388) Dr. Carpenter himself states, (812) "The parts first formed in the embryo of vertebrated animals, are such as most characteristically distinguish them from all others—namely, the vertebral column and the *spinal chord.*"

Nerve, however, may exist, and yet not be discernible. Dr. Quain, whose labours in these sciences demand attention, says, "It is frequently said that as there are multitudes of animals in which no trace of nervous matter has hitherto been demonstrated, we are not warranted in inferring its existence: yet, when we observe groups of these in a drop of water under the microscope, and see them make determinate efforts, in eluding one another, in seizing their prey; when we note their various movements so like in order and method, those of animals higher in the scale, we cannot hesitate to admit that they are *susceptible of external impressions*; i. e. are the *subjects of sensation*, and that they are capable of originating distinct acts of volition."

225. Dr. Grant observes in his Lectures on Comparative Anatomy, "The nervous globules of poriferous animals in whose soft gelatinous matter we cannot expect to find nervous filaments, are diffused through every part of the homogeneous cellular tissue of the body, which possesses the same properties in every part, and is infinitely divisible without destroying its vitality. Their ciliated gemmules, however, are endowed with remarkable living properties, and powers of spontaneous motion. They have an object in their motions: they can accelerate, retard, or cease at pleasure the vibrations of their cilia. They can change the direction of their course in the water, perceive each other's vicinity, revolve round each other, distinguish the most suitable place for the fixing of each species, or bound forward from a state of rest: *yet these gemmules contain no visible fibre.*"

226. Moreover the author before us himself acknowledges, (375) that "the organic nervous fibres (termed gelatinous by Henle,) are chiefly found in the Sympathetic System." "They are (under the microscope) flattened, soft and homogeneous in their appearance, *bearing a considerable resemblance to the non striated or organic muscular fibres*; and like them they contain numerous cell nuclei, which are arranged with tolerable regularity." Of muscular developement he says, (339) "at an early stage of developement there is no difference between the striated and non striated muscular fibre. Both are simple *tubes* containing a *granular* matter in which no

definite arrangement can be traced, and presenting enlargements occasioned by the presence of the nuclei." Contrast these statements again, with his description of ordinary Nerve fibre, (374.) "The Nervous fibre in its most complete form, is distinctly *tubular*. It is composed externally of a very delicate transparent membrane which is apparently quite homogeneous. This is obviously analogous to the myolemma of the Muscular fibre," &c. And again, (378) "The second primary element of the Nervous system, without which the fibrous portion would seem to be totally inoperative is composed of *nucleated cells* containing a finely granular substance, &c. The size of these vesicles is liable to great variation; the globular ones are usually between one three-hundredth and one one-hundred-and-twenty-fifth of an inch in diameter." The stellate processes in the ganglion globules are composed of a finely granular substance resembling that of the interior of the vesicle with which they seem to be distinctly continuous. If traced to a distance they are found to divide and subdivide, and at last give off some extremely fine transparent fibres which seem to lace and interlace with those of other stellate cells and which may perhaps become continuous with the axis cylinders of the nerve tubes." (388) "The first developement of the nerve fibre appears to take place like that of muscular fibre by the coalescence of a number of primary cells into a continuous tube," &c.

227. Dr. Quain, speaking of minute microscopic details, thus expresses himself. "When a thin layer of Nervous substance is examined with a microscope, it presents the appearance of small granules, placed in lines more or less regularly: but their form and size are liable to vary. They have been taken by some observers for globules, and have formed the basis of many *speculations*, concerning the nature of Nervous action; but they resemble much more nearly the delicate flakes observed in coagulated albumen." The organic nerve fibres are said to be usually of smaller size than the tubular, their diameter averaging between the one six-thousandth and the one four-thousandth of an inch.

228. We thus perceive that there is nothing here, providing we understood the phenomena of cell life, to draw any very positive or boastful conclusions upon, and at all events nothing sufficiently demonstrable, to form a pretext for overturning Science as hitherto received. We must have something far more conclusive than a mere transcient microscopic glance, and an hypothesis based thereupon—before we can give up the long-entertained importance of the Nerve fibre. As to *Reproduction* being effected simply by the ordinary processes of Nutrition, &c., without any direct dependence upon the Nervous system any Tyro in natural life knows to the contrary. Dispositions of the Mind, such as—Anticipation, passion, emotion, &c., are the ordinary natural precursors to the legitimate result: Various conditions, sensations, &c., of the Nervous system form the source, the prime agents, and the accomplishers of the whole phenomena, and the susceptibilities of the one in whom the ova are fertilized are even proverbial."

It will not do to regard phenomena of every day life, known by the mass of human beings, as frequently productive through the mental and nervous disturbances, which they create, of the most tremendous and fearful consequences—as processes resembling the innocent falling of the pollen of a plant, or the serene waftings by the gentle zephyr of a few particles of dust from the interior of a flower, upon some other beautiful, but yet inanimate, and unconscious growth of vegetable Nature. Such views would tend to throw down the bulwarks of Creation, the noble distinctions which the Great Author of all things has conferred upon His creatures; and carried out universally, would strip man of his highest and most noble faculties and affections, and place him on a level, beneath the brute creation, with the lifeless statue, or the senseless structures of Inorganic Nature.

Reproduction has Nerve function at its commencement—Nerve function during its consummation—and Nerve function all the way through. (See Carpenter's Physiology, 404.) At 372, already quoted, he says, "The Nervous system taken as a whole is the instrument of all those operations which peculiarly distinguish the *Animal* from the *Plant;* and it serves many additional purposes, connected with the organic or vegetative functions which the peculiar arrangement of the animal body involve."

There is little doubt however that not only is Reproduction the result of certain conditions of the Nervous system, but that it primarily originates in the *Mind* itself. Not only are the various peculiarities, gifts, talents, passions, propensities, deformities, and diseases of the material body, existing at the period of conception, bequeathed from the parent to the offspring, but there is great reason to believe, and many facts to justify such belief, that the future being is developed also *mentally* in exact conformity to the preponderating mental condition existing at this specific period, and is, indeed, a perfect transcript mentally and physically of one or both parents. Thus, how frequently do we behold the progeny of the sottish landlord, (who goes to rest each night in a state of beastly, senseless inebriety,) imbecile, weak-minded and grovelling, or, as is not unfrequently the case, a confirmed idiot. What may be denominated a chemical compound of mind with John Barleycorn. Parents beware! Ye that love your children, take not the fire into your bosoms:—avoid the waters of death—the Indian fire water! Avoid animal passions! 'Flee youthful lusts!' Abandon sin! 'Hate the very garment spotted by the flesh! Flee yourselves to the ample provisions of the Gospel, if you would have your children noble-minded—virtuous—happy.

SECRETION, ASSIMILATION AND NUTRITION.

229. *b. f. e.* The statement that "with Secretion, Nutrition, and Absorption, the Nervous system has nothing to do"—is contradicted by all natural experience. That exciting objects awaken desire, provoke augmented nerve sensibility, and determine increased afflux of blood—increased secretion, and greater energy for the performance of function—in all the secretory organs of the body, as well as those appertaining to the preparation of food, is a matter of constant observation. (See Dr. Carpenter's work, 482, 488.) Each organ has its appropriate stimulus, and these all act through the nervous system—frequently through the senses, for instance, hunger is created by the smell, sight, &c.

230. Bichat contends that organic sensibility and contractility are incessantly brought into play by these processes. "It is, (says he,) by its organic sensibility, that the gland selects from the mass of blood the materials proper for its secretion. It is by its insensible contractility that this organ rises, if I may be allowed the expression, to expel from within these matters heterogeneous to the secretion. The first (sensible contractility) exists in a trifling degree in each gland: in

the tongue and the nostrils which allow proper food only to enter the stomach; animal sensibility is very great; the former effect in an insensible manner what the glottis so evidently effects by convulsively resisting the entrance of any foreign body. The blood contains the materials of all the secretions of the nutrition and exhalation of every organ. Each gland draws from that common reservoir, what is required for its secretion, as each organ borrows from it what suits its nutrition, and as each serous surface selects what serves for exhalation. *Now it is by its peculiar mode of organic sensibility that each living part in the economy thus distinguishes what its functions require.* On the fluids approaching the small vessels of the gland, this sensibility is the sentry that warns, and insensible contractility the agent that opens or shuts the doors of the organ, accordingly as the principles must be admitted or rejected. Let be allowed this simile, it conveys an idea of what takes place. The whole glandular action then depends upon these two properties, and as this action is, as it were, permanent they are incessantly in action."

231. Microscopic observation does not appear to have recognized any great difference in the cell structure of warm blooded animals. It is to be borne in mind, also, that however beautiful and imposing may be the doctrine of cell life, yet it has never disproved that even organic cells themselves are not absorbed—assimilated and deposited under the influence of Nerve force. If this were not the case what other principle could superintend, direct and determine the form, dimensions, construction, species, distinctive organs, and Nature indeed of the animal mechanism in which they are deposited? They are deposited under the influence of Life, and not in a dead structure—or simply in obedience to their own attractions. Autenrieth appears to have had an eye to this when he says "the first law that regulates the formation of different animal substances seems to be a force of attraction of similar parts for each other. But the particles of living structures *have a great attraction among themselves*, and therefore do not leave their combinations to unite with the particles of the nutrient fluid, while they attract to themselves the analogous particles from the blood; so that in the exertion of this affinity, it seems to be the blood which principally suffers a separation of its elements.

"Bone secretes (thus) only osseous matter; muscle secretes, fibrin, and even a morbid schirrus or a steatoma, grows by the deposition of analogous matter. The growth by the attraction of similar particles is not manifested merely in the chemical components of an organ; even in its *organization* a similar law prevails."

"A polypus excrescence of the vagina or nostrils differs less in chemical composition than in its organization from the surrounding healthy parts. Once formed, however, it continues to a certain extent to grow with its own peculiar structure."

232. That individual 'cell growth's' or organizations are not of themselves the prime movers, and centres of Force in the Animal economy, as Dr. Carpenter would lead us to imagine in the processes of Secretion, Absorption, Assimilation, and Nutrition, is beautifully replied to in the conclusions arrived at by the celebrated Liebig, in his remarks "on the Phenomena of Motion in the Animal Organism." (p. 207,) "By means of the *Electrical Force* (he observes,) or that of Heat we can give the most varied directions to the manifestations of *Chemical Force*. By these means we can fix, as it were, the order in which the elementary particles shall unite. Let

us remove the cause (heat or electricity) which has turned the balance in favour of the weaker attraction in one direction, and the stronger attraction will show itself continually active in another direction; and if this stronger attraction can overcome the vis inertiæ of the elementary particles they will unite in a new form, and a new compound of different properties must be the result.."

These remarks lead to the consideration of (p. 196,) the *Vital Force* which is described by him not only as a cause of "growth in the mass—and of resistance to the external agencies, which tend to alter the form of structure, and composition of the substance of the tissue in which the vital energy resides, but as a cause of motion, and of change in the form and structure of material substances, by disturbing the state of rest in which these *chemical forces* exist, by which the elements of the compounds conveyed to the living tissues, in the form of Food are held together."

233. The Vital Force causes a decomposition of the constituents of food, *and destroys the force of attraction, which is continually exerted between their molecules: it alters the direction of the chemical force in such wise, that the elements of the constituents of food arrange themselves io another form, and combine to produce new compounds, &c.:* it further changes the direction and force of the attraction of cohesion, destroys the cohesion of the nutritious compounds, and forces the new compounds to assume forms altogether different from those which are the result of the attraction of cohesion, when acting freely, that is, without resistance."

ASSIMILATION.

234. The vital force is also manifested *as a force of attraction*, inasmuch as the new compound produced by the change of form and structure in the food, when it has a composition identical with that of the living tissue, becomes a part of that tissue."

SECRETION.

235. "Those newly formed compounds, whose composition differs from that of the living tissue, are removed from the situation in which they are formed, and, in the shape of certain *secretions* being carried to other parts of the body, undergo in contact with these a series of analogous changes."

236. "*The Vital Force* (p. 204,) *appears as a moving force or cause of motion when it overcomes the chemical forces (cohesion and affinity) which act between the constituents of food, and whea it changes the position or place in which their elements occur; it is manifested as a cause of motion in overcoming the chemical attraction of the constituents of food, and is, further, the cause which compels them to assume new forms.*" "It is quite certain," (says he, p. 210,) that in these cases "the momentum of force, or of motion in the vital force was more powerful than the chemical attraction existing between the elements of food." "The chemical force which kept the elements together acted as a resistance, which was overcome by the active vital force."—"Had both forces been equal, no kind of sensible effect would have ensued.—Had the chemical force been the stronger, the living parts would have undergone a change."

237. That the vital force is not developed by the mere motion or attraction of living cells is evident in that as he propounds, it is at all times accompanied, or *preceded by a peculiar change of form and structure in the substance of certain living parts*—for instance, in the manifestation of mechanical motion, we see, that a part of the muscular substance loses its vital properties, its character of life;

separates from the living parts, and loses its capacity of growth, and its power of resistance. *That this change is accompanied by the entrance of a foreign body—oxygen,* (admitted during respiration) into the composition of the muscular fibre—and that all experience proves that *these changes are mutually proportional.*"—"The change of matter (p. 222) the manifestation of mechanical force, and the absorption of oxygen, are, in the animal body, so closely connected with each other that we may consider the amount of motion, &c., and the quantity of living tissue transformed, as proportional to the quantity of oxygen inspired and consumed in a given time by the animal."

238. The manifestations then of the Vital Force according to Liebig, are dependent "on a certain form of the tissue in which it resides conferred upon it by the great Creator, as well as a fixed composition in the substance of the living tissue." He illustrates it, (217) by the chemical action of zinc and acid upon each other; and the change in form and structure which both undergo. The acid loses its chemical character; the zinc enters into combination with it. The manifestations of force produced in the *wire* are the immediate consequence of the change in the properties of the acid and the metal; one particle of acid after another loses its peculiar chemical character; and we perceive that in the same proportion the *wire* acquires a chemical, mechanical, galvanic, or magnetic force. If we employ it to overcome chemical or mechanical resistance, to decompose chemical compounds, or to produce motion, the chemical action continues, that is to say, one particle of acid after another changes its properties." He now applies these familiar scientific facts to the animal organism, and says, "*We know with certainty that the Nerves are the conductors and propagators of mechanical effects; we know that by means of them motion is propagated in all directions.* For each motion we recognise a separate Nerve, a peculiar conductor, with the conducting power of which, or with its interruption, the propagation of motion is affected or destroyed." It is evident from perusal of his work, that this Author, by the term "*motion*," employs it to express not only the voluntary and involuntary muscular actions of the frame, but also all the other actions involved in the chemical decompositions, combinations, and removal of disorganized material—not only the physical, but chemical and atomic movements—such as secretion, excretion, &c. (See 5—8.)

239. We see, then, that this illustrious Professor of Organic Chemistry, views the Vital Force as the grand mover, and first cause of, all the actions of the frame, and the *Nervous system* as the *medium* by which all its functions and powers are exercised.

240. Dr. Carpenter, (603) after describing the influence of the Nervous system upon the *capillaries*, visible in the act of blushing,—also (contradictorily to his statements 840) admits its influence upon the secretions.—"But," says he, "the effects of this influence are no less sensible in other cases; and particularly in the regulation of the quantity of certain secretions in accordance with the mental state or the condition of the system generally." "To the mode," he observes, "in which this regulation is effected, the act of blushing seems to afford a key; for it indicates that the supply of blood afforded to the glands, *may be entirely governed by the influence of the Nervous system* upon the calibre of the arteries. Thus the nursing mother at the *sight*, or even at the *thought* of her child, when the usual time for suckling approaches,

feels a rush of blood to the breast, exactly resembling that which takes place to the cheeks in blushing, and popularly termed "the draught;"—this rush occasions an almost immediate increase in the secretion, (836, 837.) In like manner we may explain the influence of the *mental* state upon the *amount* of the secretions of the lacrymal, the salivary, and many other glands; its influence upon their *quality*, must *probably* be effected through changes in the condition of the blood itself. Compare this with the statement quoted 840.

ACTION OF THE HEART.

d. "That the *action of the heart*, arteries, and capillaries is an action in which the Nervous system has no direct concern," is best refuted by Dr. Carpenter's own statements. (See 603, above.)

We have already quoted from his work (586,) the following passage:—"There seems much reason for attributing to the Sympathetic system of Nerves a control over this power (of dilation and contraction), and consequently the office of regulating the local distribution of blood in accordance with the wants of the different parts. It is well known that the *Nerves of this system are copiously distributed upon the arterial walls; and it has been experimentally shewn that they have the power of producing contractions in the larger arteries.* Moreover, there is every reason to believe, *that the diameter of the capillary blood-vessels, and the rate of the movemement of the blood through them, is much influenced by these Nerves;* and it seems highly probable, therefore, that they should have a corresponding influence upon the size of the trunks from which these capillaries are delivered." Again, (600) "Any circumstance, then, which increases the functional energy of a part, or *stimulates* it to increased nutrition, will occasion an increase in the supply of blood, altogether irrespective of any change in the heart's action." He shews, (601) "That *active congestion* is developed in this manner from acceleration of the local circulation *arising from an excess of functional activity in the part*—a state that may be produced artificially by the application of *gentle stimulants*—and that this is also usually the first change that occurs when their action proves sufficiently violent to produce *inflammation*, (139—142.)

In addition to the quotations already given, Dr. Carpenter attributes "the action of the heart, (842) to the excitation of its muscular tissue, by a stimulus (the blood), applied to itself, and its movements executed in a manner in which the Nervous system has no direct participation. The peristaltic movement of the Intestines, he attributes to a like cause. He however, states, (393) concerning reflex movements, "*We are not to suppose that the stimulus acts at once upon the muscles without the Nervous system being concerned at all, throwing them into contraction by its direct influence.*" Now, who is prepared to shew that the action of the heart is not a reflex movement—for although its action continues a-while after its entire removal from the body, yet this is also the case with other organs whose action is admitted to be reflex — the *pharynx*, or *gullet*, for instance—but the division of its Nervous connections is always productive of the destruction of its excitability much earlier than when they remain entire,—especially if the respiration is maintained? It is also noticed by this gentleman, (580), "That Valentine ascertained that after the heart has ceased to beat, its contractions may be re-excited by stimulating the roots of the Spinal Accessory Nerve, or of the first four

Cervical Nerves, Irritation of the *Par Vagum*, also, has a tendency to accellerate the heart's action, or to re-excite it when it has ceased, and that the action of the heart may be also affected more directly through the sympathetic system, and that without doubt it is through its Nervous connections, and probably the smpathetic system, that the heart receives the influence of mental emotions." But even the action of the heart, so strenuously contended for, as moving by simply inherent muscular power, in many parts of his work, is, we think, entirely yielded to the influence of the Nervous system in the following passages, (928)—"The Sympathetic Nerves possess a certain degree of power of exciting Muscular Contractions in the various parts to which they are distributed. Thus by irritating them immediately after the death of an animal, contractions may be excited in any part of the alimentary canal, from the pharynx to the rectum, according to the trunks which are irritated; in the heart after its ordinary movements have ceased, in the aorta, vena cava, and thoracic duct, in the ductus choledocus, uterus, fallopian tubes, vas deferens, and vesiculæ seminales. But the very same contractions may be excited by irritating the roots of the Spinal Nerves, from which the sympathetic trunks receive their white fibres: *and there is consequently strong reason to believe that the motor power of the latter is entirely dependent upon the Cerebro Spinal System.*"

RESPIRATION.

g. Dr. Carpenter further states, that the interchange of Oxygen and Carbonic Acid, which take place in the Lungs, between the atmosphere and the Venous blood, and which is the essential part of the function of Respiration, is an operation of a merely Physical character, with which the Nervous system can have no direct concern. The vast number of experiments performed upon this subject, it is true, have hitherto been attended with no very satisfactory result. They are all more or less of a conflicting character. One Physiologist, Dupuytren, believed that the chemical union of these substances was prevented by division of the *nervi vagi.* Sir Astley Cooper observed the gradual diminution of *Animal Heat* after ligature of the pneumo gastric nerves.

In other experiments in which the nervus vagus was divided or tied, incomplete palsy of the muscles of the glottis ensued. In others, exudations in the Lungs. &c., &c., all which results finally terminated the existence of the animal by suffocation.

241. If the lungs are the organs in which the vis nervosa is developed by the chemical action of the oxygen upon the venous blood—it would *a priori* be absurd to expect any great change to ensue or arrest to this chemical action from the division of any Nerve which could be employed only to distribute or return that influence or nerve force thus originated to or from the several organs which require it for the performance of their functions. It is primarily distributed through the brain, the spinal cord, and the Ganglionic system, and the only complete arrest to the chemical process would be found in the complete division of every nerve arising from or going to these organs. If such is the case, the origin of the whole nervous system, ought, by anatomists, to be described as arising from the Pulmonary organs; as distributed to every organ in the body, and as receiving returning branches from all these, in order to make the electrical circuit complete.

242. It forms no part of the present essay, however, to investigate by what particular nerve, or class of nerves

any given phenomenon or function is performed. The only question which concerns Neuropathology, is:—are all these phenomena developed by the influence of Nerve Force? To this we think a full and sufficient, nay, indeed, universal answer in the affirmative has already been obtained. The ordinary mode of strict Physiological investigation, as pursued in the present day, appears to us to admit no conclusion which cannot be proved by direct experiment. Such a procedure, no doubt, is invaluable to the interests of true Science. But, in the instance just now adduced, we have one of our ablest modern Physiological teachers—assuming a positive conclusion upon premises of the least possible satisfactory nature. On the one hand, this Physiologist modestly and deliberately declares, (929), that "It is difficult to speak with any precision as to the functions of the Sympathetic system." There is *reason to believe*, however, that it constitutes the channel by which the passions and emotions of the mind affect the organic functions, and especially through its power of regulating the calibre of the arteries, &c. He further declares, that "of the distinctive functions of the grey or organic fibres, we have no knowledge whatever;" and yet, in the same publication, positively asserts, in the face of all that has hitherto been done to this effect, that with the functions of Digestion, Absorption, Assimilation, Circulation, Nutrition, Secretion, and Reproduction, the *Nervous system has little or nothing to do.*

Truly, this is a mode of placing the extinguisher upon all future investigation into phenomena of life, which possess the most intense interest. Such statements, if heeded, must tend to the unsettling the minds of students— blockading the ports of science — closing the avenues of truth, — and hindering in proportion to the value of the publication, the march of future investigation. Although the interesting subject before us lies to some extent enveloped in clouds of mystery—and it has as yet been impossible to assign to every specific fibre its own peculiar function—yet a broad basis—and connected chain of self-evident probabilities—facts—and analogies, have been discovered, which, although they cannot in all instances establish individual functions—bid defiance to successful contradiction—and have already proved abundantly useful, in unravelling the knotty mysteries of the human frame—in the relief of human suffering—and the removal of the diseases incident to mankind.

TREATMENT OF DISEASE.

Here we notice a full manifestation of the truthfulness and applicability of Neuropathology.

We have shewn (109), that the causes of disease act chiefly upon the Nervous system, and the removal of the cause is the first or *sine qua non axiom* in the medical treatment of disease, without which no ultimate benefit can be expected. It is the nervous system, the seat of the vital powers, which is the subject of all disturbing actions in the animal economy; and it is also to the nervous system that we must look for the primary establishment of any action that can rid the body of disease. It has long since been admitted by the greatest medical authorities, that the cure or removal of disease is alone attributable to the operations of the vital principle. (42.) It is also a fact, well established, and commonly admitted by the profession, that in no disease may the vital energy be so far reduced, as to render the reactive and restorative energy of the frame incapable of conducting the functions to a propitious termination—but rather to moderate, curb, and direct its actions into those channels wherein the greatest degree of safety, and if possible, the speediest return to the normal condition can be secured. The annihilation of the powers of the vital energy, is frequently witnessed where the result was by no means anticipated. In fevers and inflammations, under the most judicious and skilful management, where great vital energy and corporeal strength are normally witnessed, and an ordinary and proportionate amount of depletion is adopted for the relief of the symtoms, and for the security indeed of the life of the patient—some unforeseen circumstance arises that unexpectedly removes still more and more, constitutional vigour—or some modification of symptoms occurs—which renders all available strength vitally important.

It is now seen with regret, that if the ultimate phase of the disease could have been beheld *a priori*—depletion might have been somewhat spared—and the life of the sufferer placed in a much less perilous and precarious condition. But in the hands of the ignorant and unskilful, how frequently has the previous reduction of power to be lamented by the experienced practitioner who is subsequently called in. Blood has been uselessly taken—or venesection actively adopted for the relief of symptoms which when duly analyzed, are found to belong only to the nervous class of disease—or exhaustive irritation; in which transfusion (injection of blood into the veins), would have formed a much more judicious remedy.

A class of medical practitioners exists who are denominated "Expectants," whose chief design and practice is to foster and preserve this all-important vital energy. This system permits unimportant symptoms to pass, a mode much to be preferred to the error just alluded to. It quietly waits for the unmolested powers of the system to transact their own business, and effect the phenomona of cure in nature's own way, avoiding the exhibition of any remedy which shall in any wise diminish, excite, or subsequently lower constitutional energy—or direct the process of cure into any path not evidently marked out by natural indications. They watch, and expect, until such time as nature develops her own method of cure, or until active, or violent action is set up, when (we suppose), this is met by appropriately active remedies—and so moderated as that, being kept within bounds, nature shall fulfil her own purposes, or effect the restoration of the patient. The removal of an individual from the influence of the causes of disease, will, itself, in many cases, be productive of cure. The abstaining from injurious diet and habits, the adoption of better air, ventilation, and exercise, seasonable periods of rest—a due observance of regularity in meals, &c., has, in many instances, afforded a rational method of cure—and especially the removal of the patient to the sea-side, or some other powerfully healthy locality. These facts all evince that the vital force—or natural powers of the constitution—have only to be subjected to the ordinary natural influences which the Great Creator has so beneficently provided, to enable them to restore the frame to its wanted energy and health.

AIR.

In the Treatment of disease by change of air, it was observed by Sir James Clark, how manifestly the influence of the mountain air, (sea breeze, &c.) or that of the humid plain, or confined valley, are observed to differ in their effects, both upon the inhabitants themselves, and in those who go there, suffering from disease.

"In the former," says he, "we have the firmly knit frame, the florid countenance, and the elastic motions of the mountaineer;" and in the latter, "the sallow complexion and languid gait" of the inhabitant of the plain. These expressions all physiologically signify in other words the amount of tone, nervous energy, contractile vigour, or otherwise relaxed and unstrung condition of the nervous tissue acting upon the parts to which they minister. "The contrast is equally strong," he observes, "when these individuals are suffering from disease." In the former, we have acute febrile and inflammatory affections; in the latter, diseases of slower progress, with comparatively little excitement of the vascular—but with *great sensibility* of the nervous system." "Were any proof necessary that this difference depended on the locality, we find it in the fact that persons, in removing from one district to another, gradually assume the characteristics, both of health and disease, of the new locality," &c. That all these conditions arise not out of the influence of the particular atmosphere upon the fleshy or vascular tissue — fat—skin—&c., but upon the entire nervous tissue spread abroad upon the whole surface of the body, is evident by the nerve signs, and sensible feelings, abundantly noticed by any invalid in his removal from one of these localities to the other. Any sensitive person may readily perceive, almost immediately, the tendency to chill—languor—lassitude—pallor — disposition to free diaphoresis—and augmented sensibility of the nervous system—incident to the humid atmosphere. On the contrary, the nervous buoyancy, tone, and muscular energy, which are felt—in the mountain air or dry atmosphere of the sea coast, with sandy substratum; together with the ruddy complexion and healthy skin, are ordinarily observed in all those who resort to these latter situations.

TREATMENT OF DISEASE BY MEDICINE.

In no instance is the truth of Neuropathology more abundantly verified, than in the ordinary treatment of Disease by medicine.

On the occurrence of acute inflammatory, febrile, and other affections, in individuals possessing a sound constitution, medical science propounds her powerful antiphlogistic measures—bleeding, venesection, active aperients, diaphoretics, and depressants, mercury, &c. &c. The vital force, acted upon by many of these medicaments, arises in angry reactive energy, and expels with violence the invading enemy from her territories. But there is a Fact lately established in Medical Science, and which does not as yet obtain credence in all quarters—that Medicine is *capable of engendering disease, as certainly as it is capable of its removal.* These potent remedies, or indeed any of them individually, persevered in for a considerable period—*may prove superior to the powers of the constitution;* and indeed a well known train of nervous symptoms are occasionally manifested, which require their exhibition to be either considerably diminished in quantity, or altogether abandoned. The nerve signs developed are those of ordinary nerve irritation, conjoined with extreme debility or exhaustion, pallor, tremblings, &c. &c.

If the remedies are continued, sleeplessness may be added, or faintness—with tumultuous action of the heart, &c. If still persisted in,—impairment of vision—noises in the ears—demand for fresh air—with all the other symptoms of exhaustion, gasping, sighing, blowing, moaning, with incalculably rapid pulse, &c. If still continued — coma, convulsions, and death close the tragic scene, and terminate the sufferings of the unfortunate victim. To the inexperienced eye, the symptoms may so nearly resemble those which an unfavourable turn of the disease might itself induce, that the effects of the remedies may be mistaken for the disease — the treatment instead of being abandoned, may be more assiduously followed up, and the patient must of necessity sink under the awful consequences of inexperience. Besides, the very nature of the disease in question, is only another manifestation of exhaustive irritation, produced in various localities of the nervous system by the action of irritants—and must of course ultimately exhibit, if protracted, the same nerve signs as in all other cases (109), of this nature.

But the truth of Neuropathology is further evinced, in the Fact that, towards the close of very many acute diseases, which have been actively treated in the way above described—several *doses of narcotic medicines* have to be prescribed before the patient can be restored to a state of convalescence, and that especially after the exhibition of calomel and other mercurials. In some instances, a clearly apparent attack of dysentry—diarrhœa—colic—or other affection indicative of "intestinal irritation"—and in others sleeplessness—pain—or the return of febrile action—*without any apparent cause*, render their exhibition necessary.

We have witnessed many cases in which this remark has been verified.

These considerations lead us to the employment of remedies termed *Anodynes.*

ANODYNES.

"The sensation of pain seems to be essentially connected with the operation of the Nervous system."—(Dr. Whiting, C. P. M. vol. 1, p. 95.)

"It is very probable that in some painful diseases there is *nothing morbid except the function of the nerves themselves;* no organic alteration, no inflammation being discoverable, either before or after the death of the patient." Pain, in such cases, is commonly called neuralgia. "Probably that peculiar property of the Nervous system, which we denominate *sensiblity*, or the capability of feeling, becomes so increased, in some instances, as to produce by itself the sensation of pain: yet in other cases *the sensibility of the nerves seems to be increased and pain produced by certain appreciable changes in the condition of the part which is the seat of pain; and this may he illustrated by what occurs in inflammation; pain being almost the constant accompaniment of the other symptoms.*"

Here is evident recognition of the increased susceptibility of Nerve in inflammation. Next to increased irritability of the Nerves, either connected with or independent of inflammation"—the writer before us notices spasmodic *contraction of muscles as a cause of pain!*—which he accounts for by the circumstance of the *pressure* which must be made upon the Nerves by the contracting muscular fibre! "Of course," says he, "when the *Nerves are rendered morbidly sensible by inflammation*, &c., the pain from spasm will be more severe." He further admits, however, "*Many facts warrant the conclusion, that in some morbid conditions of body, excessive sensibility of the Nerves and muscular spasm, often co-exist, as essential parts of the same disease.*"

These then, and others given, are some of the states of Nerve in which the writer contends that anodynes may be administered. "It may, however," says he, "with propriety be remarked, that *in such diseases as inflammation and spasm, the pain may often be suspended during their continuance by the medicines which are strictly called anodynes*, i. e. *medicines which reduce the sensibility of the nerve, &c.*" "*In spasm, indeed, the same remedies which are calculated to allay pain, will frequently also allay inordinate action of the muscular fibre*," &c. "The exhibition of anodynes in inflammation, however, requires the exercise of much judgment. This remark appears to be the more necessary because the employment of some of them, especially opium and the prussic acid have been of late strongly recommended as antiphlogstic remedies." "*Pain or tenderness is one of the most unequivocal signs of the existence of inflammation,* where taken in conjunction with its other symptoms," &c.: and its continuance will often afford an indication that further active measures are necessary, (143), But it is quite certain *that inflammation in a considerable degree may be going on while all feeling of pain is suspended by the effect of an anodyne;* so that in such case the indication of pain will be lost, the disease may be rendered obscure, and the treatment inert." It is evident in these statements that the pain felt in inflammation, is admitted to be resident in the nervous system; for the remedy which removes nerve pain and spasm, is declared to suspend it here during the continuance of anodyne, or in ordinary medical phrase, to 'mask the symptoms.' "Anodynes also are contraindicated frequently in inflammation, on account of their exciting and stimulating qualities; "but instances are daily met with in practice, especially of chronic inflammation, where the suspension of pain by anodynes is indicated by the considerations already asssigned."

We may here observe how precisely all these statements develope the views hereinbefore introduced, how rich they are in Neuropathological truths. How constantly excitation—increased sensibility—nerve pain,—and that condition that developes muscular spasm and inflammation, are identified—not only in theory but in the employment of the selfsame remedies. "In all these instances, medicines," says our author, "which are strictly called anodynes, act either by reducing the sensibility of the nerves, or by rendering the brain so torpid that painful feelings are not noticed."

"It may be fairly questioned whether these medicines, when they are administered by the stomach, do not all produce their effects in the same manner, *by reducing the sensibility of the whole nervous system, and by thus rendering it less susceptible of feeling.*" "As a *morbid degree of sensibility* seems sometimes *by itself* to constitute a painful disease, the employment of anodynes may be occasionally required as the principal means for the cure of such disease," &c.

Again, let us notice as a further illustration, the usual treatment of a case of Chronic Bronchitis, occurring in a constitution shattered by years of excessive study, care, anxiety, stimulants, improper food, and sedentary habits. In such case, no potent medicinal remedy can be administered with impunity, unless its irritating qualites are to some extent sheathed or guarded by such medicines as compose, sooth, and tranquilize the Nervous system. The medicinal agent which is employed in such cases is generally henbane, or hemlock, prussic acid, belladonna, morphia or opium. In other instances, where the hysterical form of nerve irritation presents in a delicate and somewhat emaciated constitution, every aperient that is administered has to be compounded with a narcotic to prevent exasperation of the motor nerves, which might bring on an attack, or more generally to ward off the severe spasms, gripings, tenesmus, or accumulations of flatus which are so distressing in this malady—and would speedily arise from any severe local intestinal irritant.

In the treatment of Pulmonary Consumption, the Neuropathological Treatment of Disease is greatly verified. In order to show the implication of the great nervous centres in this disease, I may adduce the following case as an ordinary illustration of this fact. A patient, suffering from this malady, and who had formerly been an ardent lover of tobacco—had been obliged to lay aside his pipe, and discontinue this pernicious practice. One day, however, during my visit, I found him once more endeavouring to " blow a cloud." He persevered for a few minutes, but trembling of the limbs, quivering of the lips, shrinking of the features, and an universal lassitude, faintness, swimming, and nausea obliged him to desist. Again and again, he had attempted to sooth his unstrung nerves, by even a few puffs of the once-loved weed; but invariably discovered as the disease advanced, less and less capability of enduring its not long ago completely mastered effects. In this disease the remedies that are found most efficient, and frequently administered, such as the mineral acids, quinine, &c., have all to be accompanied by doses of Hyoscyamus, (henbane), Conium, (hemlock,), &c. *Counter Irritants* of every description are used to the skin during all stages of the complaint. Morphia forms an admirable, and indispensible composing pill, at bed-time, as the disease advances. Conium enters largely into the treatment in the shape of inhalations, &c., &c.; and as the disease approaches its third stage, Morphia, or Opium become the chief remedies to be depended upon for freedom from cough, and the attainment of a few hours quiet, rest, and sleep. Finally, as the diarrhœa sets in, which so usually occurs towards the close of this affection, opium in one form or other forms the sheet-anchor, without which the storm-driven vessel must in many instances at once go down. It may be observed, even in this slight sketch, that Nerve Irritation is predominant all the way through this common, and yet destructive malady.

We may also in this place notice the use of opium in *Delirium Tremens*,—a complaint which arises from excessive stimulation, and is defined by Dr. Gregory as " a disorder which has for its proximate cause, a peculiarly excited state of the Nervous system." " The occurrence of similar symptoms in cases of extreme inanition, would lead us," says he, " to believe that *exhaustion of Nervous power*—expresses perhaps more accurately its intimate nature."—(136.)

In the fearful disease termed Schirrus, and its termination in open Cancer, and indeed all other *painful* maladies, how eminently useful is the narcotic preparation, Morphia, or even Opium itself, in procuring alleviation from suffering, which no other remedies can effect. The former is often sprinkled in powder upon the very surface of the sore itself, and is found most rapidly effectual in this manner. Observe, also, as in all other cases in which the Nerves are concerned, how each succeeding dose has to be *augmented in quantity or power*, as the medicinally incurable disease advances—and nature, *or the living Nerve, becomes habituated to the drug.*

But what we have now said in short illustration of a great fact, may indeed be affirmed, more or less, of every kind of chronic disease. Every medical practitioner well knows how eminently valuable, and absolutely necessary are these substances in the medical treatment of diseases of long standing. Why this is the case, has been already somewhat discussed in the articles, (62, 64, 110); and it may be further stated, as a fact, that *chronic disease has no existence where the great centres of organic life are not previously implicated, and in which they may not be referred to as the ultimate sources of the prolonged affection.*—(172.)

Further, he remarks in addition to all antiphlogistic measures—bodily rest—a mild and unirritating diet—wholesome air—a moderate temperature—and mental repose—(*i. e.* the absence of all neural irritants), are specially enjoined in all cases in which either fever or inflammation are present, as being highly conducive to the accomplishment of their subjugation. And of the last he says, "Mental excitement is capable of disturbing all the bodily functions, and of exasperating every symptom of fever."

While these lines are in the press, I am attending, in conjunction with another Medical gentleman, a case of Infantile fever, in which the ordinary practical and Neuropathological views of Medical Practitioners are well illustrated. This gentleman, in consultation, remarks upon the *great nervous susceptibility* of our little patient, He powerfully descants upon its consequent *liability to hydrocephalus*, (water in the head), and the undoubted necessity for caution in the employment of irritating medicines. He concludes by suggesting the exhibition of calomel in conjunction with only a mild aperient, (for suspected worms) —*combined with an Anodyne*—in order to prevent undue action upon the alimentary canal—which might by sympathy be transferred to the *brain*, and thus increase the tendency to *Irritation*, or even *Inflammation of that organ.*

ANTISPASMODICS.

245. "*In whatever manner muscular action takes place, it may be affirmed that it is altogether attributable to the nervous system.*"—Dr. THOMSON.

If after muscles have contracted, they retain this condition, when the exciting cause has ceased to operate, they are said to be in a state of spasm, and such medicines as have the power of resolving this state, are termed antispasmodics." If narcotics allay irritability, sooth pain, and produce diminished susceptibility to the impressions of exciting agents, it may reasonably be inquired in what respect antispasmodics differ from narcotics? The chief differences in these two classes of remedies, is that the latter produces insensibility to impressions—and collapse—the other not. Another point requires consideration, viz.: whether antispasmodics are to be regarded as stimulants or sedatives? "If our hypothesis," says he, "be correct, they have a sedative operation; for, if the irregular or inordinate action which they overcome, be the *consequence of irritation, either mental or corporeal, it follows that in resolving spasm, the susceptibility to impression in the extremity of the motor nerves must be diminished, and this can be the result only of a sedative power.*"

The complaints in which these remedies are employed, are as their name implies—spasmi—or spasmodic diseases—such as chorea—epilepsy—asthma—hooping-cough—colic—hysteria, &c., &c.—which have been already shewn to belong to the class Neuroses, or Disorders of the Nervous System."—(See 177, 124.)

Diseases of the heart, perhaps, more evidently display their Nervous origin than those of any other organ. The intense anxiety, sudden terror, and feeling of impending and immediate dissolution, that accompany even slight functional disturbances of this organ, evince how intimately its actions are connected with the *Nervous* system.

Moreover, diseases of the heart more frequently result from a perturbed state of the *mind*, than from any other cause. How often do great "reverses of fortune," a sudden fright, unfortunate speculations, continued grief, care, anxiety, &c., lay the foundation of those diseases in this organ, which Time, that destroys all things, is unable to remove.

We well remember the case of a joiner and builder submitted to our care, who, during the high state of suspense and anxiety arising from the expectation of the momentary fall of an edifice in which his whole capital was involved, contracted disease of this viscus, which rapidly shortened his days. But the opinion is not without its advocates, that even formidable affections of this organ, such as hypertrophy, &c., do nominally arise from a preternaturally irritable, or excited state of its nutritious or motor nerves, which constitute the first stage of the disease.

A celebrated modern author, speaking of these diseases, observes :—"Organic disease of the heart is only a symptom of irritation in the great Nervous network about the stomach, generated by food, by alcoholic drinks, or by mental affections—all acting on the centre of nutrition, whence morbid sympathies are propagated to the centre of circulation, producing irregular action there." "The morbid sympathies sent from the digestive organs to the heart, so long as they affect only the nutrition of the Nerves of the heart, cause only varying palpitations, but in the course of time affect the nutrition of the muscular substance of the heart, and thus organic disease of this organ is established." It need not, however, be wondered at that the origin of diseases of this organ, generally, should be looked for in the condition of the Nervous system—modified in their various phases by existing conditions of the blood—digestive organs—habits—climate, &c. &c. when we remember, how sensibly, and with what facility they are excited by all the imponderable forces, Light, Heat, Electricity, &c. by sound—Food—Spirits, and other stimulants—by emotion—the Passions—and indeed by almost every powerful agent in Nature. It is more wonderful rather how this all-important organ is enabled to continue its functions for any length of period at all without disease.

In the treatment of the disease of this organ, termed *Angina Pectoris*, Dr. Forbes recommends "*Nervines*,': such as *Antispasmodics*, *Cordials*, *Carminatives*, &c., as better than anodynes. "They have appeared in different cases to afford relief by imparting a temporary vigour *to the Nervous system generally*, overpowered, as it seemed, (locally one would say), by stimulating *the heart* to increased action, and thereby enabling it to propel the load with which it was oppressed; or simply by invigorating *the stomach*, and enabling it to expel the flatus accumulated in it. He also recommends "venesection (bleeding), in plethoric states of the vascular system—followed by brandy and slight doses of laudanum, and the probability of benefit will be greater in proportion to the degree of exhaustion and nervousness present."

Here is an ordinary illustration of the watchful regard which a talented Physician always pays to the all-important Nervous system.

The organ affected in this disease, is that which propels forward all the blood which circulates through the frame, As its Nerves are in a very exhausted and yet irritable condition, (exhaustive Irritation), a trifling amount of overwork may cause immediate dissolution. It is therefore necessary, although the patient may be himself weak at the onset—that it should be relieved of an amount of its labour, by removing blood from the frame;—and then when labour is lessened, stimulants and nervines are poured in to strengthen and invigorate the Nervous energy; and in proproportion to the degree of exhaustion and nervousness present, will be the probability of benefit obtained.

In the interval, the Nervous system, besides other methods of treatment, is "to be attacked at other points by Counter Irritation, Setons, Issues, Blisters, &c."

COUNTER-IRRITATION.

246. Dr. Williams, who has written on this subject, says—"This term, which is of recent introduction, has been adopted in medicine to designate any *Irritation* artificially established, with a view to diminish, counteract, or remove some other *Irritation* or *Inflammation* existing in the body. He thus holds the views set forth under the head of Inflammation and Fever, (160), viz., that the Irritations existing in these disorders and in purely nervous affections, are identical in nature and are treated and cured by the same means. Some *internal medicines*, as purgatives, emetics, &c., probably in part owe their efficiency to the *counter irritation* which they cause." "*Nature*," says he, "not rarely cures diseases by *counter. irritation*; and it was probably from her example that Art first adopted the practice. It is a common case to see *an inveterate functional disease subside on the appearance of a cutaneous eruption.* This more frequently occurs in *sub-inflammatory affections of the mucous membranes*: but examples are not wanting in which *mania, paralysis, chorea,* and various other diseases have been similarly cured. The ex-anthematous and other *eruptive diseases* are probably cases of a somewhat *analogous* description—and the occurrence of the *eruption* is within certain limits salutary. This is proved by the *relief* manifestly *afforded* to the internal *functions*,—and frequently by the *moderation of the Fever* on the external eruption of measles, small-pox, scarlatina, erysipelas, &c. Again, the fact of inflammation and nervous irritation being identical, is further shewn in that experience continually proves that," as says this gentleman, "under certain conditions of the system, a *blister* or other counter irritant *aggravates the inflammation* which it was applied to remove." If we enquire what those conditions are, we shall find them chiefly to conist of an *excited* or *irritable* state of the general circulation, (prevailing fever), and a *susceptibility or excessive sensibility of the nervous system.*" Further, it is well known that if a blister be applied at *too early a stage of inflammation, i. e.* before a good deal of the irritability of the part is reduced by other measures, or is placed too near the seat of inflammation, of the serous membranes for example, their contiguity may greatly aggravate it—*(i. e.* the production of Nervous Irritation where it is already excessive, may considerably increase the existing augmented sensibility,) "*causing two inflammations as it were, to run into one.*" Shewing also the identity of condition of Nerve in the effects of the remedy as well as in the existing disease. "Another form of medicinal counter irritant is that in which heat in such a degree as to cause disorganization of the part, is applied to the surface of the body in the form of red hot iron, copper, or burning substan-

ces, which by the profession are frequently termed "the actual cautery." "The common effect of all these, is the formation of an eschar or dead slough, surrounded by a more or less intense inflammation, which causes the separation of the dead part, and the production of an ulcerous cavity in its place. The local inflammation thus excited may be very intense, and the suppurative discharge very perfect. And this kind of counter irritation is proportionably energetic in its effects on the disease, in the same manner as others. But, it is observed, there seems to be another peculiar result from the application of vehement heat, namely, a *strong impression, or shock on the nervous system,* which in certain diseases is not without its salutary influence."

"The *cautery has been found useful* in checking violent *convulsive* diseases, such as *epilepsy, hysteria,* and *local spasms,* &c. &c." "It is difficult to judge whether its efficacy depends on the *pain or on some other change wrought in the Nervous system;* the effect is certainly sometimes produced *before* such a degree of *local inflammation* has been excited as could act by vascular counter irritation."

Cauterization by substances in the state of combustion is frequently employed, and which is perhaps the most *painful* of all other processes of the kind, in white swellings, deep-seated inflammations, diseases of the spine, &c. &c.

PHYSIOLOGICAL ACTION OF POISONS.

247. These views are further corroborated by the Physiological action of Poisons on the animal frame.

The earliest views which prevailed in reference to the action of these substances, were, that their remote effects were due to the *impressions* which they make upon the *sentient extremities of the nerves,* which impressions are transmitted to the brain, and thence by a reflex operation to different parts of the body. In 1811, Mr., now Sir B. Brodie, published a paper in the Philosophical Transactions, in which he endeavoured to prove, that while some poisons internally administered, act by *nervous impression;* the same substances, with several others, when applied to wounds, pass by venous absorption into the circulation, in the course of which they are carried *to the brain,* whose functions they suspend or destroy by actual contact.

"That many substances of a noxious nature," remarks Dr. Apjohn, "do, at least, occasionally pass into the blood, would seem established by satisfactory experiments." "There are, however, numerous facts which negative the supposition of absorption being necessary to their poisonous action." "Some, as strong Prussic Acid, *kill with such rapidity,* that it is impossible to refer their action to absorption and cerebral contact; and in the case of others which operate more slowly, *analysis seldom enables us to detect the slightest trace of them in the blood;* a fact, however, which can scarcely be considered conclusive against absorption, in consequence of the comparative defectiveness of our means for conducting such delicate investigations."

248. A celebrated experiment of Magendie is often quoted in support of the views of poison by absorption. This eminent Physiologist, having reduced a dog to a state of stupor by opium, amputated one of its thighs, and then re-established the circulation through the member by the intervention of quills, &c., which were so secured as to continue the circulation of the sanguineous fluids along their natural channels in the divided arteries, and

veins. An incision was now made in the paw of the amputated leg, and a small quantity of ticunas (poison) inserted in it. After the usual time the animal was found to labour under the influence of the poison. Here it is said the limb having no connexion with the body, the hypothesis of Nervous impression cannot apply, so that the action of the poison can only be referred to absorption, and *cerebal contact* Messrs. Morgan & Addison (who have revived the old theory of the general action of poisons being the result of a sympathy between the *Nerves with which they come in contact, and the brain)*, judiciously remark, that all this experiment of Magendie's proves, is, that the ticunas had no doubt passed into the circulation—but having ascended beyond the quill connecting the amputated ends of the vein, its influence upon the system may be due *to the impression which it makes upon the Nervous fibrils which are distributed upon the internal coat of the vein ;* an impression, which by sympathy is extended to the brain. These gentlemen have also adduced in support of nervous impression, several weighty arguments, and some very ingenious experiments.

249 "They would really seem," says Dr. Apjohn, "to have rendered it highly probable *that the inner coats of the blood-vessels are extremely susceptible of morbific impressions ;* and that the influence of poisons, when thus applied, is developed without any cerebral contact. Ticunas, for example, introduced into the femoral artery (of the thigh) of a dog, produced death in 108 seconds ; and when inserted into the carotid artery (leading to the brain), was not fatal until after the same length of time, although in this case it must have been almost immediately conveyed to the brain."

But that this poison may prove fatal without entering the blood at all, and of course without being conveyed to the brain, they established by the following decisive experiment. Two large bull-dogs, each weighing about forty pounds, were so operated upon that the lower half of the divided carotid artery, (blood-vessel) in one dog, was made continuous with the upper half of the divided carotid in the other. The former was then inoculated on the back with concentrated strychnine, which had previously produced death in such animals in about three-and-a-half minutes. In three minutes-and-a-half exactly the inoculated animal exhibited the usual tetanic (muscular spasm) symptoms, which result from the action of this poison, and died in about four minutes afterwards. The other dog was now separated from the dead animal, and neither during the progress of the experiment, nor at any subsequent period, did he exhibit the slightest symptom of the action of the poison.

It is impossible to account for these results upon the hypothesis of absorption. Had such taken place, both animals being exposed to introduction of the poison by the circulation, must obviously each have suffered from its influence ; while on the other hand, the immunity experienced by one of them, is in perfect accordance with the theory of *nervous impression, and cerebral sympathy.*

Dr. Apjohn observes "that this doctrine is also supported by analogy. When, as in tetanus, (lock-jaw) the general system becomes deranged by the infliction of a local injury of a mechanical kind, the effect can obviously (as there is no poison here to be absorbed), only be attributed to a sympathy subsisting between the sensorium, and the nerves of the wounded part." "Are we not, therefore, justified when similar effects follow the application of a poison to any particular part of the body, to conclude that the medium of its operation is the same, or that the constitution becomes generally affected by reason of the *sensorium sympathising with the nerves, to whose sentient extremities the poison is applied ?*"

"From these and other considerations," continues he, "which it is unnecessary to adduce here, we are disposed to concur in the conclusion that, though poisons may occasionally enter the circulation, *their deleterious effects are, in almost every instance, if not all, to be ascribed to the impressions which they make upon the Nerves with which they come in contact, which impressions are conveyed to the brain, and thence by a reflex operation, to the different organs of the body.* We wish, however, particularly to guard against being understood to deny the absorption of poisons. Many such have been detected by chemical examination in the blood, but almost invariably in cases where a considerable interval has elapsed between their administration, and the death of the animal; and *even in such instances, the experiments of Morgan and Addison furnish the strongest grounds for believing that their deleterious influence was due, not to immediate contact with the substance of the brain, but to their application to, and the consequent impresssions made, upon the network of nervous fibrils spread upon the serous membrane which lines the entire vascular system.*" "Lastly, the action of the more energetic narcotics which destroy life in a few seconds must, of necessity, be explained *by the direct influence which they exert over the Nervous system ;* and as it is unphilosophical to refer similar effects to dissimilar causes, strong probable grounds are laid for the universality of the principle for which Addison and Morgan contend."

250. It is clear, however, that whatever may be the subject of difference, whether the brain, the organic system, or the mere branches of nerve are affected,—or however the results are brought about, *all authors cling to the opinion that it is some part of the Nervous system that is primarily affected in the operation of poisonous substances.* The experiments of Addison and Morgan, however, render it probable that in many instances, *the Great Ganglionic centres—the true "centres of life,"*—which administer to the functions of all the vital organs and entire vascular system—that these, and not the brain, are the chief organs upon which the mortal blow is struck, which produces the rapid mortality observable in the effects of Alcohol, Prussic Acid, &c. The important question has yet to be solved, whether in many cases of poison, it is not the *Great Ganglionic System* which is the chief subject of attack — and whether, in such, if the brain is at all affected—whether it be not merely symptomatic of the more serious and vital blow. The experiments already produced upon decapitated animals, especially those related of water-dogs, by Magendie, certainly appear to answer in the affirmative. "The derangement which follows the application of poison, is seldom alike all over the body. A poison will specially affect some particular organ or organs, while others appear to be little, if at all disturbed. Thus the power of tobacco, and the upas antiar, as was long ago noticed by Sir B. Brodie, is principally exerted upon the heart. Opium, and a number of other narcotic drugs act chiefly upon the brain, while the influence of the different vegetable poisons, which include strychnia and brucia, is chiefly directed to the spinal chord. The action of some indeed is pretty equally distributed over the entire system. Yet even in the case of these, we may recognise

a tendency to assail some in preference to other structures. The ravages, for example, of mercury and arsenic, extend to every part of the body. The former, however, as is well known, acts most forcibly on the glands, the latter upon the mucous tissues: nor are these two metals peculiar in this respect. Every substance possessing medicinal efficacy, (and many such are poisons in an overdose), has been introduced into our Pharmacopœias, chiefly in consequence of possessing one or more of these specific properties. The terms anodyne, purgative diuretic, diaphoretic, sialogogue, &c., &c., owe their origin to, and at the same time attest, the knowledge which we have acquired from experience of, the determination to particular organs, (or rather to particular departments of the nervous system) of the virtues of medicinal agents." — *Cyclopædia of Practical Medicine*, vol. 4, page 192.

We here observe, that although this Author is speaking of, and advocating the *specific action of poisons upon the nervous system*, there is a constant tendency from the ordinary usages of the Profession—to forget Nerve—and advert to the action of the poison as operating directly upon the substance and structure of some special organ.

For the following arrangement of Poisons, as at present generally adopted, we are indebted to Fodere, slightly modified by Orfila and Chrisson.

POISONS.

1.—*Mineral Irritants*

Chlorides of Lime and Soda.
Iodine and Hydriodate of Potash.
Phosphorus.
Sulphuric, Nitric, Muriatic Acids.
Oxalic Acid, Potash, Soda, &c.
Nitrate of Potash, Ammonia, &c.
Nitrate of Silver, Muriate of Gold.
Mercury, Arsenic, Copper.
Lead, Zinc, Antimony.
Bismuth, Tin, Barytes, &c.

2.—*Vegetable Irritants.*

Euphorbia, Elaterium.
Colocynth, Bryonia, &c.
Pulsatilla, Mezereon, &c.
Sabina, Jalapa, &c.
Camboge, &c. &c.

3.—*Animal Irritants.*

Cantharides.
Poisonous Fish.
Poisonous Serpents.
Poisonous Animal Matter.

4.—*Narcotics.*

Prussic Acid, Opium.
Hyoscyamus, Lactuca.
Solanum, &c.

5.—*Narcotic Acrids.*

Belladonna, Stramonium.
Tobacco, Hemlock.
Cicuta, Aconitum,
Hellebore, Foxglove.
Veratrum, Colchicum.
Nux Vomica, Brucea.
Cocculus, Upas Antiar.
Camphor, Secale Cornut.
Alcohol.

251. It is at once seen that this whole category of poisonous substances, as set forth by these eminent Toxicologists, is also a veritable list of remedies in ordinary use in the Practice of Medicine. It has been shewn by several eminent individuals, that many of these substances are liable to exert a positively injurious, and even poisonous influence upon the human frame, whether administered in large, or more diminutive proportions, and extended over a much greater period of time. Such therefore, if administered at all, require at least much integrity, skill, judgment and discretion, in their administration, even in the most minute doses. It is also discovered, that the further use of many of these substances, after administration for a given length of time, is absolutely contra-indicated or rejected by the constitution. After this period has arrived,

which varies in different constitutions, if still persisted in—they are found to be not only disadvantageous, but positively injurious. *Habitual* medication, therefore, must prove in all cases hurtful, if not destructive.

As an illustration of the action of poisons upon the Nervous system, we shall now advert to the effects of those in most common use, and then close this department of our subject.

ARSENIC.

252. This substance is employed as an ordinary remedy in Diseases of the Skin and Nervous System.

The following is an abstract of the class of *Nervous* Symptoms produced by long-continued employment of *small doses* of arsenious acid, which are more or less modified in different cases, but in all evincing that the chief action of this mineral is exerted directly upon the Great Ganglionic System.

SYMPTOMS.—"Disorder of the digestive functions, characterized by *flatulence, sensation of heat, or actual pain in the stomach and bowels, loss of appetite, thirst, nausea, and vomiting, purging*, or at least a relaxed condition of the bowels, and griping, furred tongue, with dizziness and tightness of the mouth and throat, or with salivation. *Quick, small, and sometimes irregular pulse, oppressed respiration, with a dry cough.* The *body wastes;* the stomach being frequently so *irritable* that no food can be retained in it. *Headache, giddiness, and want of sleep*, are frequently observed. *The limbs become painful, feeble, trembling, subject to convulsions, occasionally benumbed, and ultimately paralyzed.* Sometimes there ensues a cutaneous eruption—or the hair and nails fall off—&c., and under those and other symptoms, the patient gradually sinks, in some cases retaining his consciousness to the last, but at other times delirium or stupor supervening."

LEAD.

253. Lead too, may be gradually introduced into the constitution, either in the form of medicine, or from the drinking of water containing some chemical elements, which act upon the lead reservoirs or tubes in which it may be contained, and developes the following train of *Nervous Symptoms.*

Generally, the *digestive organs* are at first, more or less affected. There is *failing of the appetite, constipated bowels*, and white tongue. *Flatulence, and irregular pains in the belly*, accompany these symptoms. By and by, the complexion acquires a pallid, dingy, or sallow cast, *emaciation* begins to ensue, and *loss of strength, nervousness, and irritability*, are observed, as well as *a quick and wiry pulse. Sleeplessness prevails.* The margin of the gums, where they are in contact with the teeth, is of a distinct *blue colour.* If the cause is not removed, all the symptoms increase in severity, and genuine *lead colic* is produced. There is *excruciating pain* in the bowels—*pain of a twisting, griping character*, and (*evincing its decidedly Nervous character*), *generally more or less relieved by steady pressure. The walls of the abdomen are contracted, and the abdominal muscles are drawn into hard lumps or knots.* There is *flatulence* frequently, and sometimes *vomiting* during the paroxysm, and *cramp of the lower limbs* is not unfrequent, attended with obstinate *constipation and tormenting colicy pain.* These paroxysms *occur at intervals* more or less protracted. After a time, as the disease proceeds, the affection of the muscular system becomes striking. *Paralysis of the hands and wrists ensues, and these become useless. After a while, the ankles are affected in like manner*, and the patient is unable to bend upwards the foot. If the disease still progresses, the muscles, from inability to use them, gradually waste, and become remarkably flat and shrivelled—and as the complaint advances, all the muscles share the same fate, and the patient becomes a miserable cripple. Organic disease of some vital organ sets in, and the individual gradually sinks and dies. In this case, it is seen that nearly all the symptoms are of a decidedly Nervous character.

254. But the two great Poisons most especially to be guarded against, either in their large or diminutive doses, as entering so much more into the usages and habits of society, are the Poisons *Mercury* and *Alcohol*, or ardent spirits. There are, with the exception of food, no substances taken so *universally* into the human frame, by the inhabitants both of civilized and many barbarous countries. Yet there are none more pernicious to healthy existence, undermining to the vital powers, and fatal oftentimes to the entire organism, than the two dire, terrible, and destructive substances, the subjects of the present discussion.

ALCOHOL.

255. Alcohol, in the form of brandy, gin, rum, beer, wines, &c., when taken into the stomach, "is speedily absorbed, and carried into the blood, which thus contaminated, acts more or less injuriously," says Dr. A. Combe, "upon all the organs of the body, but *principally on the Nervous system*, producing in the first place an excited action, which is afterwards followed by a corresponing depression, and this in its turn producing a *craving* for a fresh supply of the stimulus. It is by this constant craving, that the habit of drinking is contracted. Further, on the healthy condition of the blood, depends the healthy action of every organ of the body. Liquids, when received into the stomach, are speedily absorbed by the capillary vessels of the mucous membrane, and passing directly into the blood, immediately affect its composition by the addition, (in the case of Alcohol) of a foreign and abnormal ingredient. Sir Benjamin Brodie found "that, by the administration of a large dose of Alcohol (ardent spirit) to a rabbit, the pupils of its eyes became dilated, its extremities convulsed, and the respiration laborious. This latter function was performed at longer and longer intervals, and at length entirely ceased. Two minutes after the apparent death of the animal, he opened the thorax, (chest) and found the heart acting with moderate force and frequency—*but circulating dark coloured blood.* The same phenomena resulted from the injection of two drops of the essential oil of bitter almonds," (which contains prussic acid) "diffused in half-an-ounce of water, into the bowels of a cat." "How pernicious then must be the practice which thus alters the normal composition of the blood, by the habitual use of large quantities of spirituous liquors!" "Thus altered, it is no longer in a condition to afford healthy nutriment to the various organs, on all of which it exerts an injurious influence, which is, however, most apparent in its action on the *Nervous system* from the directness of the effects produced."

256. Its evils which are most marked, are the enfeebling of the automatic Nervous system, impairment or ruin of the digestive functions, organic disease of the heart, liver, kidneys, &c., congestion of the brain, local or general dropsies, weakened intellect, and perverted affections; imbecility and paralysis are among the more frequent results of indulgence in Alcoholic or Spirituous liquors. But not the least of all the evils attendant upon this poisonous system, is the moral and intellectual degradation of the drunkard. We just now remarked, that,

the subsequent depression itself produces a craving for a fresh supply, and experience shows the difficulty—we may almost say— impossibility of weaning habitual drunkards from their favorite vice. "Alcohol, and Alcoholic fluids, generally," says a well-known writer, Dr. Apjohn, "when swallowed by man in moderate quantity, invariably produce a greater or less degree of *excitement*, i. e. they augment the temperature of the body," by causing, we would say. "acceleration of the movements of the heart and respiratory system, give a (temporary) tone and (apparent) strength to the muscular system, (transient) energy and rapidity to the operations of the mind," &c. But although these are the primary effects of Alcohol, yet, in all cases, there is more or less of a corresponding and *ulterior languor and depression*, in accordance with a well-known law of the action of excitants and stimuli on the Nervous tissue. It will be indeed found, that the supposed augmented strength and energy, is gained by needlessly augmenting the action of the heart and lungs, by the *more rapid expenditure of Nerve force*, or vital energy, which is one great cause of the desire for a repetition of the stimulant when the powers begin to flag. Still we must admit, that in cases of extreme emaciation, debility, and inanition, by disease, which would most assuredly have perished, this poisonous liquid has frequently, in our own hands, supported, preserved, and ultimately saved from death, many individuals suffering from the last stage of apparently hopeless disease, and has, to them, been metamorphosed into the water of Life.

257. In these cases, and in others of extreme debility, where the parties refuse any other method of relief, philanthropy and compassion could not withhold what is *immediately necessary to existence*, although really injurious effects might afterwards ensue. Its exhibition here, would be temporarily to sustain the flickering flame, by exciting and maintaining the action of the heart and arteries for a short period, until, by the addition of nutritious aliment, it may be able to carry on, unaided, the ordinary functions of life.

258. "When taken in large quantities," Dr. Apjohn remarks, "excitement, is, in the first instance, observed, but it soon puts on a more formidable character, being attended by suffusion of the face and conjunctivæ, difficult articulation, giddiness, incoherency of mind, and very frequently true delirium. An irrepressible drowsiness next succeeds, which terminates in deep, and sometimes stertorous sleep, from which, in cases which terminate favorably, the individual awakes affected by debility, giddiness, or headache, universal languor, confused or blunted mental faculties, and often loathing of food, nausea, or vomiting." "The result, however, is sometimes different. The somnolency just described, passes not into sleep, but by feeble, and moderately rapid pulse, to a state in which there occurs stertorous breathing, and dilated and incontractible pupil, (of the eye) a combination of (apoplectic) signs, from which recovery is seldom witnessed." "The case just described, is an instance," says the writer, "of simple poisoning, by fermented liquors, and many such have been observed. It however, more frequently happens, that life is destroyed, either by the occurence during the fit of intoxication, of apoplexy in an individual predisposed to the disease, &c., or his accidental suffocation during the lethargic or somnolent state." "Should the spirituous liquor be drunk, not in divided portions, but all at once, and in large quantity, apoplectic coma,

with sterorous breathing, sets in almost immediately, and death follows, usually in a few hours."

259. "In habitual drunkards, a particular *Nervous affection*, at present known under the name of "delirium tremens," is often witnessed, which may, with propriety, be noticed here.

Delirium, characterised by constant *incoherent talking*, is its leading symptom, and is accompanied by *tremors of the limbs*, particularly the upper extremities. In fatal cases, coma, as in the preceding instance, precedes and ushers in death.

260. "With regard to the Physiological operation of Alcohol," Dr. Apjohn states, "that it is generally conceived to enter the circulation, and through this medium to *exert its poisonous influence on the Nervous system.*' "When, however, death occurs, as it often has, within a few minutes, it is difficult to admit that absorption could have taken place, and *we are compelled, with Addison and Morgan, to refer its noxious influence to Nervous impression and cerebral sympathy.*" The most rapid case on record, given by Mr. Taylor, Lecturer, of Guy's Hospital, in his "Manual of Medical Jurisprudence," was that of a man who drank a bottle of gin for a wager, in London, in 1839. In a quarter of an hour after taking the gin, he appeared intoxicated; he soon became insensible, and *died in half-an-hour*, although a large quantity of the spirit had been removed by the stomach-pump. The ordinary duration of fatal cases of poisoning by Alcohol, is said to be from twelve to eighteen hours. The following case occurred in 1840. A boy, aged seven, swallowed about three ounces of brandy: shortly afterwards he was observed to stagger, he was sent to bed, and vomited violently. In about four hours he got up and sat by the fire; his head, face, and neck, were very red, and he was in a profuse perspiration. Half-an-hour afterwards, he was found perfectly insensible, strongly convulsed, and the skin cold. He died in about thirty hours, In examination of the body of those who have died from the effects of this poison—the stomach has been found inflamed, the mucous membrane being in some cases of a bright red, and in others of a dark red, or brownish colour, attended, frequently, with unusual vascularity. But it is in the head in which the principal lesions are found. These are venous congestion, serous effusion into the ventricles, and between the membranes, and extravasation of blood into the substance of the brain producing genuine sanguineous apoplexy. When "delirium tremens" proves fatal, serous effusion is found in the brain, and in some rare instances, flakes of coagulable lymph are attached to the membranes, &c.

261. The Physiological and Chemical action of this poison, is set forth by the labours of the illustrious Professor Liebig, as follows, (Organic Chemistry, p. 229),—"According to all the observations hitherto made, neither the expired air, nor the perspiration, nor the urine, contain any trace of Alcohol, after indulgence in spirituous liquors: and there can be no doubt that the elements of Alcohol combine with oxygen in the body; that its carbon and hydrogen are given off as carbonic acid and water."

"The oxygen which has accomplished this change, must have been taken from the arterial blood; for we know of no channel, save the circulation of the blood, by which oxygen can penetrate into the interior of the body," &c. "It is consequently obvious, that by the use of Alcohol, a limit must rapidly be put to the change of matter in certain parts of the body. The oxygen of the arterial blood, which in the absence of Alcohol, would have combined with the matter of the tissues, or with that formed by the metamorphosis of these tissues, now combines with the elements of Alcohol," (the latter having a greater affinity for oxygen, than that of the compounds in the blood.)

The arterial blood becomes venous, without the substance of the muscles, (or we might add, any of the functions of life), having taken any share in its transformation." And he observes further, "that the developement of heat in the body, after the use of wine, increases, rather than diminishes, without the manifestation of a corresponding amount of mechanical force," &c.

262. Dr. Marshall Hall has also shewn, which may in some measure explain the phenomena just named, "that paralysis of the important nerve, the pneumogastric and of the dilator muscles of the larynx, or entrance to the windpipe, occurs in deep intoxication, and, consequently, the fearful Nervous affection, closure of the glottis, which by him is represented as the great source of fatality in apoplectic and convulsive diseases. It arrests entirely the functions of respiration, and causes the circulation of unoxygenized and black blood to circulate through the heart, brain, and other organs, which state of things continuing but a few seconds, must terminate in the cessation of all the phenomena of life.—(p. 280, "Diseases of the Nervous System)."

263. As an illustration of the moral degradation to which this poison subjects mankind,—we shall never forget being at one time summoned to give medical evidence at a Coroner's Inquest, where a highly respectable medical practitioner was present, in order to give evidence on two other cases,—and who summed up the whole of his statement,—by declaring that, in each instance the sole cause of death was drink! drink!! drink!!! Yet, extraordinary to relate, this same prosperous, highly-gifted, intellectual, and talented individual, who filled at the same time some of the most important medical appointments and offices in that locality—shortly afterwards became himself so enchained to the demoralising influence of this passion—that for the infatuation that possessed him, he gave up office after office, appointment after appointment,—until ultimately his entire practice was destroyed,—and himself—when unable to procure the poisonous potation by other means—degraded to the low condition of a suppliant at the door of his friends, for "just one small glass," frequently before the breakfast hour. Finally, life itself was sacrificed—and offered up in slavish devotion upon this shrine of Bacchus. Upon the tombstone marking his melancholy end, might be inscribed, as an epitaph and warning to all who hereafter might attempt to navigate the same dangerous channel,—It was all drink! drink!! drink!!! It is to be feared that it is too often a snare to the diligent, hard-worked, and even aspiring medical practitioner. Of the moral effects of this poison, it may be affirmed, with all verity and truthfulness, that it developes the seeds of vice, hardens and prepares the innocent for crime, pollutes and embitters all the virtuous fountains of social life, rapidly destroys the comforts of home, blunts and poisons all the best principles and affections of the human mind. It produces more crime—introduces more disease, wretchedness, and misery—degradation, poverty, and pain—in fact, developes more of whatever may be emphatically denominated evil: slays more victims, and destroys more souls, than all other noxious substances in the world

put together. It is this poison that chiefly peoples our workhouses—fills our prisons—gives to the asylum its inhabitants—produces the exiles of transportation—arms the midnight assassin for deeds of blood—and furnishes the chief victims for suicide, the duel, and the gallows. The pledge of entire abstinence is a valuable specific for this most loathsome disease. The maine Law would work well in our land, and ensure more perfect success. All these, however, may fail in individual instances, and in such there is no certain antidote, except the New nature so freely offered by the provisions of the Gospel. Then it is that the pledge becomes infinitely valuable, when it introduces its now rational recipient to the "Joyful Sound."

MERCURY.

264. Next in popular use to Alcohol, as a beverage, is the supposed antidote for the evil effects of this poison—given medicinally—viz., Mercury. Like spirituous liquors—mercury, when taken to excess, is, to some extent, its own antidote, giving temporary relief for the evils which it accumulates. Such is the apparent aptitude of this drug for the supposed removal of all the ills of life, that it is administered in almost every complaint—given at almost every age, from infancy to senectute, in inflammations, in catarrhs, in fevers—and in visceral diseases—in spasmodic maladies, diseases of the skin, scorbutic and syphilitic affections, in deficient, as well as augmented action of the biliary functions, in diminished secretion, as well as in the excessive fluxes of diarrhœa, dysentry, and cholera—in fact, (save with the more discreet and sagacious practitioners), in almost every variety, form, and shade of affection incident to the human frame. When taken internally, to any considerable extent, especially in some constitutions, it produces according to Dieterich, mercurial or salivary fever—a fever too often witnessed in this country. This fever is attended with *quick pulse, hot dry skin, headache, thirst, loss of appetite, nausea, &c., lassitude or muscular debility, &c., restlessness and inability to sleep,* all which symptoms are referrible to the *Nervous system,*—and characterised as mercurial by the redness, swelling, and sponginess of the gums. The whole interior of the mouth is reddened, and the tongue swells. Towards the conclusion of the fever, the glands beind the jaw swell and secrete a continual *profusion of saliva*—or the fever may be removed by increase of the ordinary evacuations of the body, &c. In other cases, the effects of mercury may appear in the form of *enteritis,* or mercurial inflammation of the bowels. It is to be observed, that at the conclusion of many diseases in which mercury has formed a part of the treatment—a new disease presents itself, in the form of *mucous irritation* of the bowels, attended with high fever—and almost induces the attending practitioner to believe (until due inquiry is instituted), that a return of the original malady is recurring—and this irritation needs all the care and discretion of the medical attendant for its subjugation.

265. Mercury may also present itself in the form of skin-diseases, as Eczema Mercuriale, &c.; in other instances it produces that bad state of habit denominated by Mr. Travers, "Mercurial cachexia." This disease is characterised by the *Nervous signs* of irritable circulation, extreme pallor and emaciation, acute and rapid hectic fever," and says he, "an almost invariable termination in pulmonary consumption." Dr. Pereira represents it as characterised by *disordered digestive organs, loss of appetite, wasting,*

incapability of much exertion, with increased secretion from the salivary glands, &c. The coagulability of the blood is diminished—the proportion of clot, and therefore of fibrin, to serum becomes smaller—and Dietrich observes, "the whole organic formation of the patient is less consistent and cohesive," &c. Another serious malady proceeding from the existence of this poisonous mineral in the constitution, is the *Nervous affection* named the "*Mercurial Tremor.*" It begins with a weakness of the muscles. The patient discovers *his limbs to be somewhat unsteady. His shaking hands* become unfit for any delicate manipulation. In the workmen who labor in the quicksilver mines, the disease assumes a much more intense form. The *gait is vaccilatory*, and the movements assume a convulsive character, the *tongue trembles, the speech stammering*, and the movements of the jaw are *odd, tremulous, and irregular.* At last the sufferer *loses the power of locomotion.* He becomes *unable to feed himself*, his appetite fails, the saliva dribbles from his mouth, digestion is impaired, and if still exposed to the noxious vapour, the disease rapidly advances, and delirium and insensibility close the scene. For an account of this affection, see the excellent work of Dr. Pereira, on the *Materia Medica*. The *salivation* which so frequently attends the exhibition of ordinary doses of this mineral, is by no means unworthy of notice in this place. The saliva and mucus, in some instances, flow from the mouth to the extent of several pints in the twenty-four hours. A coppery taste is perceived, and the breath acquires a remarkably acetic odour. Sometimes the gums are tumified and ulcerated, the tongue is swollen to such an extent that it hangs out of the mouth, incapacitating the patient from either eating or speaking. In some cases, the gums slough, (mortify), the teeth loosen and drop out, and occasionally necrosis of the alveolar processes (death of the bony sockets of the teeth), takes place. In other instances, inflammation of the soft palate, as well as other parts of the mouth, goes on to ulceration, and that to such an extent, that the tip of a finger might be laid in any of the cavities which are formed. I forbear to enumerate some of the many melancholy and fatal cases on record, as the effects of this mineral. It may with justice, however, be remarked, that probably more frequently are the formidable ulcerations of the throat, &c. occurring in syphilitic cases, the results of the *remedy prescribed*, which is given as a specific in this disease, than the consequences of the malady.

266. In order to sum up the more mild, and generally unnoticed forms of constitutional mercurialism, we who have suffered severely from its effects in our own person, would add—that after a course of its ordinary doses, it destroys the molar teeth, renders the mouth unfit for mastication—and the food has consequently to be bolted in whole pieces into the digestive canal. It greatly debilitates the functions of the stomach, and takes away the power of digestion, although we have just seen that this organ has, in these cases, often to digest large, solid, and sometimes entirely unmasticated portions of food. It *destroys the tone and secretive functions of the alimentary canal*, and sets up a *fearful state of constipation.* It *irritates the intestinal nerves and ganglionic centres*, and produces *exquisite sensibility of this tube*, rendering many of the ordinary kinds of food irritating, injurious, and even poisonous. To this internal condition, may be added the external *sensibility of the skin to vicissitudes of temperature, change of wind, damp, cold, wet. &c.*—the general

emaciation, debility, weakness, and irritability of the nervous system, and consequent fretfulness of mind—the destruction of the fibrinous portion of the blood, rendering accidental hæmorrhages, (bleedings), from wounds, ruptures of vessels, &c., dangerous, and often irrepressible. The drying up of the general secretions of the body—the loss of power—nervous energy—intellectual vigour, &c., &c., that accompany its prolonged exhibition, render the victims incapable of fulfilling any of the ordinary occupations of manly employ. We recollect when a student at the Manchester Infirmary, visiting one individual, who having taken a considerable share of mercury, his system was reduced to such a deplorable condition, and the bones to such a state of brittleness, that he *fractured his collar-bone, simply by turning in bed.* Finally, we would remark, that this Poison is fearlessly prescribed, and with great avidity taken,—and yet no part of the system escapes from its evil influence. Several Physiologists have detected Mercury in the blood. Dr. Christison states that it has been discovered in the perspiration, the saliva, in several secretions, and the fluid of ulcers. "Mercury," says Dr. Pereira, "has been found in the metallic state, in the organic solids, viz., in the bones, brain, synovial capsules, (cavities of the joints), the pleura, (cavity of the chest), the humours of the eye, the cellular tissue, the lungs, &c. But unfortunately, although so universally diffused, there is hitherto discovered no drug which is able to dislodge it from these combinations, and expel it from the system.

NARCOTICS.

267. The substances denominated Narcotic Poisons do not irritate or inflame, but nevertheless produce death with as much if not more certainty and despatch, than Irritants, and yet in the body we are frequently unable to recognise any appearances of a morbid character. The chief of these are seen in the classification given No. 4. "The symptoms produced by the Narcotic Poisons are such as indicate a derangement of the *Nervous System.*" There is pain of the head, vertigo, partial or complete blindness, stupor sometimes amounting to insensibility, paralysis, or convulsive action of the muscles under the control of the will, and previous to death, profound coma. The general opinion entertained in reference to their manner of action is, that they enter the circulation, and are by means of it conveyed to the brain or spinal marrow, upon which their powers are thus directly brought to act. Messrs. Addison and Morgan refer their action to the *sympathy* which subsists between the centre of the Nervous system, and those expansions of it on which the morbific impressions are made.

OPIUM.

268. The effects of Opium vary somewhat according to the quantity exhibited. In ordinary medicinal doses, it acts first as a stimulant, exciting the mind and adding strength and tone to the muscular system.

These effects soon subside, and are succeeded by a drowsy and lethargic state. When the dose is large, the state of excitement appears entirely wanting; or in other words, stupor approaching to coma, almost immediately sets in. The respiration is slow, labouring, and stertorous. The pupil of the eye is almost always greatly contracted. In fatal cases, death takes place within from seven to twelve hours.

"The influence of Opium, as may be readily inferred from the symptoms it produces, is exerted principally upon the Brain, or centre of the Nervous system;" and the post-mortem appearances in general are confined to the brain and spinal marrow."

PRUSSIC ACID.

269. When the quantity of this Poison swallowed is insufficient to produce death, the usual effects experienced are, pain and weight of head, particularly in the occipital region, rapid pulse, nausea, and sometimes salivation. Such symptoms have sometimes been observed in patients under the influence of the acid—exhibited for some time in medicinal doses.

When the quantity exhibited is large enough to produce death within a few seconds, the patient sinks without any (perceptible) morbid symptom whatsoever. In fatal cases, however, which run a somewhat longer course, death is invariably preceded by violent tetanic convulsion."—*(J. Apjohn.)* It is evident that the effects manifested by this poison, are produced entirely by its action upon the Nervous fibre.

270. Poisons have either a *local* or a *remote* action on the system. The local action of poisons is most strikingly seen in those substances which are of a corrosive nature," or such as are classed under the head of (1) "Mineral," and (2) "Vegetable Irritants." "A chemical change is induced by these agents in the structure of the part with which they come in contact; and should the disorganization be very extensive, death will take place as in any other case of mechanical lesion to a vital organ. If the individual survive the first effects, and the poison be not neutralized or removed from the stomach, the local irritation produced may give rise to inflammation, with ulceration, gangrene, and their consequences. But the local action is not always indicated by physical changes in a part. *The effect may be confined to the sentient extremities of the Nerves only*, manifested by the occurrence of paralysis. It is well known that (the substances of the 4th and 5th classes) aconite, morphia, prussic acid, &c., are capable of affecting the *Nerves*, if they remain sufficiently long in contact with a part; and many experiments have proved *that the Nerves supplying the hollow viscera, through which sensation is not manifested, are equally susceptible of this local action.*—(A. S. Taylor, *Lecturer on M. J., Guy's.)* Opium applied *directly* to the intestines, has been known to put an end to their peristaltic motion; and the same phenomenon was accidentally observed by Addison and Morgan, in their experiments with the Ticunas poison."

271. By *remote* action, we understand, that power which most poisonous substances possess, of affecting *(through the Nervous system)* an organ remote from that to which they are applied. The same substance often possesses both a local and a remote action; but some poisons affect one organ remotely, and others, another. Cantharides, a poison which has a violent local action, as an irritant, to whatever part it may be applied, affects remotely (through the Nervous system) the urinary and generative organs. Morphia, whether applied to a wound, or the mucous membrane of the stomach, affects the brain. Digitalis, taken internally, affects the heart; strychnia, the spinal marrow, &c. "In all cases of poisoning," says this author, "whether the substance have a local action or not, death must be ascribed to the influence exerted on a remote organ by sympathy. When a poison destroys life, without apparently entering the blood, it is said to act through a shock, or

impulse, transmitted from the sentient extremities of the nerves of the part to which it is applied ; and this is the way in which the remote influence of many poisons on vital organs is explained.

272. Some poisons appear to act only by absorption, and others independently of that process. Thus, of two animal poisons, (class 3rd)—that of the rattle-snake kills instantly, or within a few seconds, certainly within a period of time so short as not easily to allow of the hypothesis of the poison being diffused by absorption. On the other hand, the poison of hydrophobia, by its long incubation, appears to act by absorption, for we can hardly imagine if it acted sympathetically on the (local) nerves by contact, that its operation should be often suspended for so many months.

273. It is not our intention to extend the limits of this essay by digressing into the multitudinous Poisons which are in one form or other infused into the common aliments and luxuries of life, of which it may be said, indeed, "There is death in the pot," further than just to remark upon the almost universal adulteration of English flour, especially in large towns, by the *slow poison*, ALUM. The avidity with which such condiments as mustard, common pepper, cayenne ; and ardent spirits, are swallowed, in ordinary life, even at the domestic board, is extraordinary. When we apply almost any of these irritants to the skin, in a moistened condition, how quickly does the surface become reddened by acute inflammation—how soon does the fiery, smarting, and rapidly augmenting pain become so unbearable, that the hardiest individuals, and those who possess the highest character for endurance of suffering, are obliged to tear away the offending irritant. Now, every one knows, that the lining of the mouth, and consequently the coat of the stomach, which is formed of the same delicate mucous tissue, is considerably less protected than the external skin, and consequently more sensitive to injury, and prone to inflammatory action ;—and yet they heedlessly partake of these substances in such quantity as could not fail to redden, blister, or produce painful eruptions on the skin, if there applied. Nay, there are numbers who seem to imagine that what is absolutely painful and unbearable in the mouth—as raw alcohol, boiling-hot tea, &c., &c., may be transmitted to the stomach with impunity—and constantly drink liquids of such high temperature and strength, as to cause actual distortion of the countenance, by the uneasiness felt in the mouth itself. The fact is—Anatomy discovers to us that the lining membranes of the stomach, and other viscera of the body, are ill-supplied with nerves of sensation. Thus articles of an injurious, and even poisonous character, may for a long time be persevered in, before any symptom can be discovered denoting injury.

274. Disease itself may be thus developed, and slowly, and surely, progress in these organs, even to the very verge of the grave, without attracting attention to the seat of the malady,—and indeed in many instances accompanied by relief to the suffering organ, and even pleasurable sensation on each addition of the fatal dose.

275. To return to our subject. It will at once be seen, that the chief symptoms described in all the instances of Poison herein adduced, and which are only a fair specimen of the whole class of poisons, are purely of a Nervous character. They display by the universality of their influences, in inducing paralysis, tremors, depraved mental faculties, altered secretions, sensibility to atmospheric change, destruction of all nutriton, depraved muscular motion of the limbs, narcotism,

and the affection of many organs of the body at the same time, &c., &c., that their influence operates primarily and principally on the Nervous structure. They thus bear testimony to the views adduced in this essay, by demonstrating that those minerals and substances that act most injuriously upon the frame—as commonly admitted by medical men—do so by developing their effects through the medium of the Nervous system.

It is also evident, that the unavoidable deduction must be drawn with regard to the effect of medicinal agents upon the constitution. That if the Poisons which form nearly the entire class of medicinal substances—are admitted to act primarily upon the nerve structures of the body—every medicinal agent, however small may be its dose—included in the category of Poisonous substances—must proportionally, and in like manner, exert its primary action upon the Nervous organs.

276. Thus man is seen to be a living mass of Nerve. The elements that surround him, act upon him only through the medium of the external tissue and network of Nervous fibre. His Nervous organs, the senses, introduce to his cognizance the various substances suitable or unadapted to his pleasure and existence. His various wants and desires— awakened by sense—all possess a Nervous character. The substances upon which he feeds, and by which his frame is nourished — all produce a primary action upon the Nervous centres, before a single particle is added to the volume of his blood. His pleasures and pains are neural phenomena.

It is by Nerve structure, also, that he communicates his feelings, thoughts, wishes, &c., to the external world. It is by the agency of Nerve, that he performs all the multifarious, myriad operations of busy life.

All external agencies acting upon him, such as Air, Light, Heat, Food, Drink, Medicines, Poisons, &c., all operate, as we have seen, whether externally on the skin, internally in the stomach, or lungs—or yet more internally upon the membrane lining the blood-vessels themselves, through the Nervous network spread upon the several membranes of these various organs, and by no other medium.--(109.)

It is by Nervous agency, that man seizes and enjoys the various objects and substances presented to his view, all which produce pleasure or pain only in so far as they affect his sensibilities—and it is by the same power that he removes, and finally ejects what is no longer of utility.

277. In contemplating a voltaic battery, we behold the *zinc* and the *acid* as the *exciting substances* which develope the peculiar action observed. We behold the several troughs or cells in which these chemical substances are contained.—But these are not the parts of the apparatus—where we expect the chemical, mechanical, galvanic, or magnetic phenomena to be displayed. Each individual cell is but a single point of action, which could, of itself, do nothing as regards the magnificent effect about to be developed. It is in the wires of communication where all these individual actions are made to reciprocate, and where the intensity of the effect is to be produced. Just so Nerve force is developed in each individual *air cell* of the lungs—by oxygen—blood—and nerve,—and reciprocated in every individual *function* and *metamorphosis* of the frame; but the Nervous centres are the organs that we look upon as the Great Magazins or Helices of Electrical force; and it is in the Nerves alone that we find the " concentration, conduction, and propagation of mechanical," chemical, mental, functional, and other powers of this extraordinary system.

A man composed of bone only, would form but a motionless skeleton; of muscle—a mass of highly organized yet lifeless, fleshy fibre; of a circulatory system—(*i. e.*, a heart and blood-vessels only)—a wonderful apparatus designed for the developement of nutrition, secretion, excretion, &c., and for supplying the domicile with a fluid which is indispensible to its existence—but even these without a supply of Nervous energy, form but motionless organs, and useless tubes—a manufactory truly filled with all requisite machinery, but destitute of the moving force. Turn on the steam, and every wheel, pulley, spindle, loom, &c. commences with its wonted activity, So let but Nerve enter into man's composition in all its normal efficiency, and instantly every function — including respiration — and the circulation of the blood — progresses with ardour — every mechanical motion is executed with vigour—every mental organ is fired with new imagination—the eye flashes with delight—the cheeks with roseate health—the limbs with vital alacrity—and life beams through every department of the frame.

278. As all surrounding agents act thus upon his Nerves, it is not wonderful that man's diseases should betray a neural character and origin; and this has to some extent been seen in the preceding essay.

And lastly, if we have in some measure succeeded in shewing that we have diseases originating in the Nervous system to attack, we have also shewn that the medicinal remedies in ordinary use, exert their influence primarily upon the part of the system which constitutes the root, source, or origin of all hitherto observed disease.

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